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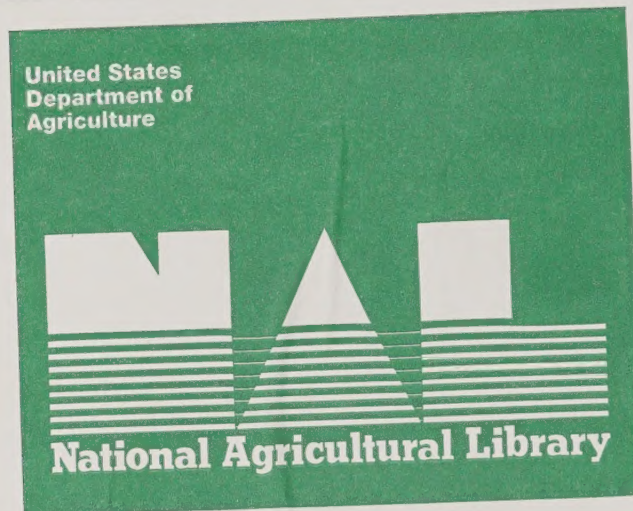
April 2003



# Sheep 2001

## Part II: Reference of Sheep Health in the United States, 2001





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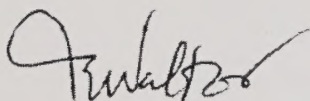
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This report has been prepared from material received and analyzed by the U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Veterinary Services (VS) during a study of animal health and management on sheep operations.

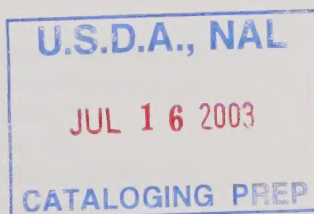
The Sheep 2001 study was a cooperative effort between State and Federal agricultural statisticians, animal health officials, university researchers, extension personnel, and sheep producers. We want to thank the hundreds of industry members who helped determine the direction and objectives of this study by participating in focus groups.

Thanks also to the National Agricultural Statistics Service (NASS) enumerators and State and Federal Veterinary Medical Officers (VMOs) and Animal Health Technicians (AHTs) who visited the operations and collected the data. Their hard work and dedication to the National Animal Health Monitoring System (NAHMS) are invaluable. The roles of the producer, Area Veterinarian in Charge (AVIC), NAHMS Coordinator, VMO, AHT, NASS enumerator, and the lab personnel at the National Veterinary Services Laboratories (NVSL) were critical in providing quality data for Sheep 2001 reports. Thanks also to the personnel at the Centers for Epidemiology and Animal Health (CEAH) for their efforts in generating and distributing timely reports from Sheep 2001 data, and to our reviewers for providing valuable expertise and guidance through their comments.

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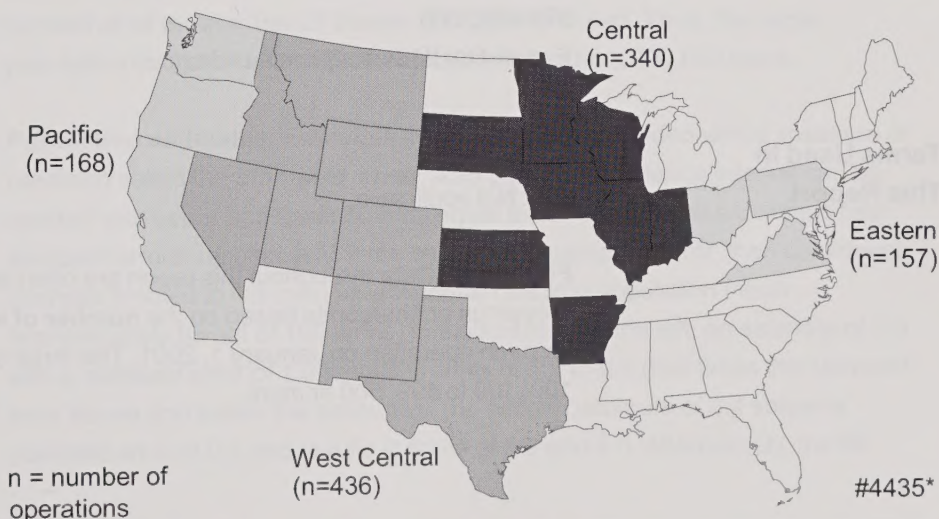
1. Source: United States Census of Agriculture, U.S. Department of Commerce, 1997 118
2. Source: United States Department of Agriculture, NASS 118



## Introduction

As part of the National Animal Health Monitoring System (NAHMS), the USDA:APHIS:Veterinary Services (VS) conducted the first national study of the sheep industry with the 1996 NAHMS National Sheep Survey. This was a voluntary mail-in survey, developed through collaboration with the Research and Education Division of the American Sheep Industry Association (ASI), and focused on identifying health and productivity issues affecting America's sheep industry. The 1996 NAHMS study results provided an overview of sheep health, productivity, and management on 5,174 U.S. operations. NAHMS' second national sheep study, NAHMS Sheep 2001, was designed to provide both participants and the industry with information about the U.S. sheep flock on operations with one or more sheep. Specific objectives of this study are described in Section II: Methodology. The USDA's National Agricultural Statistics Service (NASS) collaborated with VS to select a producer sample statistically designed to provide inferences to the nation's sheep population in 22 participating States (see map). These 22 States include the major sheep producing States, accounting for 87.4 percent of the U.S. sheep inventory on January 1, 2001, and 72.3 percent of U.S. sheep producers in 2000. Data for Part I were collected from 3,210 operations in the 22 participating States. NASS interviewers contacted producers and collected data for these reports via a questionnaire administered on-site from December 29, 2000, to January 26, 2001.

### States Participating in Part II of the Sheep 2001 Study



\*Identification numbers are assigned to each graph in this report, for public reference.

Part II: Reference of Sheep Health in the United States, 2001 is the second of a series of reports containing national information resulting from NAHMS Sheep 2001. Data for this report were collected from 1,101 participating operations that had 20 or more ewes. State and Federal veterinary medical officers (VMOs) and animal health technicians (AHTs) collected the data on operations in the 22 participating States between February 5, 2001, and April 27, 2001. The 22-State target population of operations with 20 or more ewes was estimated to represent 42.1 percent of all sheep operations and 92.6 percent of ewes in the 22 States on January 1, 2001.

Comparisons between responses to similar questions in the 1996 and 2001 studies will be made when available and appropriate. However, these comparisons are made with caution, as the study populations and survey designs are different. Discussions of NAHMS results within this report are available at: [www.aphis.usda.gov/vs/ceah/cahm](http://www.aphis.usda.gov/vs/ceah/cahm)

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## Terms Used in This Report

**N/A:** Not applicable.

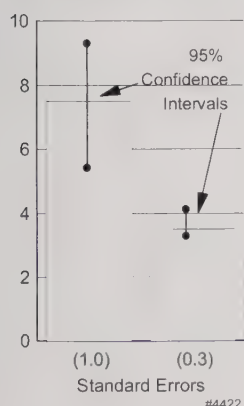
**Flock size:** Data throughout this report are often summarized by three size groupings or categories based on the **number of ewes 1 year or older** reported for each operation on January 1, 2001. The three size groupings are: less than 100; 100 to 499; 500 or more.



**Operation average:** A single value for each operation is summed over all operations reporting divided by the number of operations reporting.

**Percentage:** Data in tables are reported by percentage of operations or by percentage of lambs or sheep. Data in Appendix II are provided to aid in the interpretations of the estimates in these reports. The bulk of these reports contain many estimates of the percentage of operations that do various health or management practices. Likewise, estimates are provided of the percentage of animals receiving various health measures. Sometimes the need arises to approximate the population of operations and animals that were using "XX" health management practice. First, the target population is the 22 States for operations with 20 or more ewes. The Part I sample of operations with one or more sheep was used to estimate the coverage for Part II. Using the NASS inventory data listed in Appendix II, the majority of tables in this report can be recalculated to determine the number of operations, or sheep and lambs, that are represented by the category in the table. For example, in table 1a (p.6), 28.1 percent of operations reported that Suffolks made up the majority of their ewes. The NASS inventory data in Appendix II indicate that there are 47,800 operations in the 22 participating States and that 42.1 percent had 20 or more ewes (20,124 operations). Therefore, the number of operations with a majority of ewes that were Suffolks at the time of the interview (February 5, 2001, to April 27, 2001), was  $.281 \times 20,124$ , or 5,655 operations. The ewe inventory for the 22 States was 3,563,000 head, and those operations with 20 or more ewes accounted for 92.6 percent of all ewes in the 22 States, or 3,299,000 head. Thus, the target population for Part II is 20,124 sheep operations and 3,299,000 ewes.

Examples of a  
95% Confidence Interval



**Population estimates:** Estimates in this report are provided with a measure of precision called the **standard error**. A 95 percent confidence interval can be created with upper and lower bounds equal to the estimate plus or minus two standard errors, respectively. If the only error is sampling error, then confidence intervals created in this manner will contain the true population mean approximately 95 out of 100 times. In the example to the left, an estimate of 7.5 with a standard error of 1.0 results in limits of 5.5 to 9.5 (two times the standard error above and below the estimate). The second estimate of 3.4 shows a standard error of 0.3 and results in limits of 2.8 and 4.0. Alternatively, the 90



percent confidence interval would be created by multiplying the standard error by 1.65 instead of two. Most estimates in this report are rounded to the nearest tenth. If rounded to 0, the standard error was reported. If there were no reports of the event, no standard error was reported.

**Primary Flock Type:** Because some producers manage more than one type of flock, they were asked to identify their *primary* flock type (e.g., open, fenced range, etc.). Therefore, data throughout this report are often summarized by three flock types (self-classified by the producers): herded/open range; fenced range; and farm flock. The category “all operations” includes feedlots. However, only 0.7 percent of operations with 20 or more ewes on January 1, 2001, were primarily feedlots. These operations, while not representative of feedlots in general, did represent the few feedlot operations that also raised ewes.

**Regions:**

**Pacific:** California, Oregon, and Washington.

**West Central:** Colorado, Idaho, Montana, New Mexico, Nevada, Utah, Texas and Wyoming.

**Central:** Arkansas, Illinois, Indiana, Iowa, Kansas, Minnesota, South Dakota, and Wisconsin.

**Eastern:** Ohio, Pennsylvania, and Virginia.

**Sample profile:** Information that describes characteristics of the sites where Sheep 2001 data were collected, such as operations responding by flock size. (See Appendix I).

**Total inventory:** All sheep and lambs present on the operation January, 1, 2001.

## Section I: Population Estimates

### A. General Management

#### 1. Breed composition of ewes

The highest percentage of operations (28.1 percent) reported that Suffolk ewes accounted for the majority of their flock. The Suffolks may have been crossed with another breed (not pure), but , if crossed, represented the dominant genetics of the majority of ewes. The highest percentage of ewes (40.9 percent) were Rambouillet, which represented a majority of the flock on only 12.7 percent of operations. The “other breeds” category indicates that the majority of ewes were of a breed composition not listed in table 1 a. The “multiple breeds” category refers to operations that had ewes of different breeds (not crossbreds), none of which comprised the majority of the flock. The “crossbred” category refers only to operations where the majority of ewes were crossbred and the producer could not define which breed was dominant. Many of these were either Suffolk or Rambouillet crosses.

a. Percentage of operations (and percentage of ewes<sup>1</sup> on these operations), by breed composition of the majority of ewes:

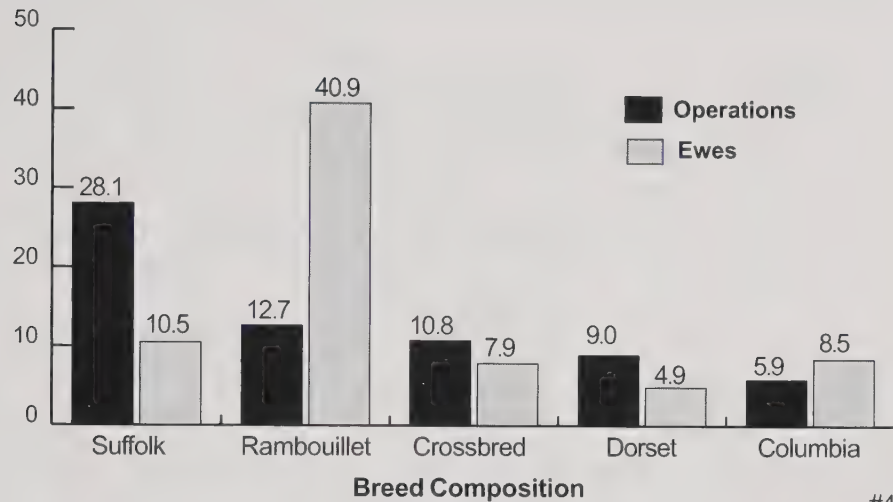
Breed	Percent Operations	Standard Error	Percent Ewes	Standard Error
Border Leicester	0.3	(0.2)	0.6	(0.4)
Cheviot	1.7	(0.6)	0.5	(0.7)
Columbia	5.9	(0.9)	8.5	(1.0)
Corriedale	2.5	(0.9)	0.9	(0.3)
Dorset	9.0	(1.3)	4.9	(0.6)
Finnsheep	0.4	(0.2)	1.2	(0.7)
Hampshire	4.7	(1.2)	1.5	(0.3)
Montadale	1.0	(0.4)	0.3	(0.1)
Oxford	0.6	(0.3)	0.4	(0.2)
Polypay	4.7	(1.1)	3.9	(0.8)
Rambouillet	12.7	(1.2)	40.9	(2.3)
Shropshire	1.2	(0.5)	0.6	(0.2)
Southdown	0.9	(0.6)	0.3	(0.2)
Suffolk	28.1	(2.2)	10.5	(1.0)
Targhee	3.8	(0.7)	7.9	(1.2)
Other breeds	8.7	(1.4)	7.7	(1.3)
Multiple breeds (no crossbreds)	3.0	(1.0)	1.5	(0.3)
Crossbred (no predominant breed)	10.8	(1.7)	7.9	(1.2)
Total	100.0		100.0	

<sup>1</sup> Ewes 1 year or older at time of interview (February 5 - April 27, 2001).



### Percent of Operations and Percent of Ewes, by Breed Composition of the Majority of Ewes

Percent



#4458

The previous table represented the dominant genetics of the majority of ewes on the operation which may be termed the "primary breed." Producers were asked if their identified primary breed was a crossbred. Nearly half (49.3 percent) of operations reported that the majority of their ewes were crossbreds.

b. Percentage of operations (and percentage of ewes<sup>1</sup> on these operations), where the primary breed of ewe was a crossbred:

Percent Operations	Standard Error	Percent Ewes	Standard Error
49.3	(2.4)	48.7	(2.3)

<sup>1</sup> Ewes 1 year or older at time of interview (February 5 – April 27, 2001)

## 2. Composition of lamb crop

On 39.7 percent of operations the majority of lambs were purebred. A total of 34.2 percent of ewes were on operations where the majority of lambs were purebred.

a. Percentage of operations (and percentage of ewes<sup>1</sup> on these operations) by composition of the majority of the 2000 lamb crop:

Composition	Percent Operations	Standard Error	Percent Ewes	Standard Error
Majority of lambs purebred	39.7	(2.4)	34.2	(2.1)
Majority of lambs crossbred (2 breeds)	36.2	(2.3)	39.0	(2.3)
Majority of lambs crossbred (3 or more breeds)	24.1	(2.0)	26.8	(2.0)
Total	100.0		100.0	

<sup>1</sup> Ewes 1 year or older at time of interview (February 5 - April 27, 2001).

## 3. Age of ewes

a. Percentage of ewes<sup>1</sup> by age category:

Age	Percent Ewes	Standard Error
1 year to less than 2 years	20.2	(0.6)
2 years or older	79.8	(0.6)
Total	100.0	

<sup>1</sup> Ewes 1 year older at time of interview (February 5 – April 27, 2001).

#### 4. Flock additions (not raised on the operation)

During the previous year, just over one-third (34.1 percent) of operations added ewes or ewe lambs not raised on the operation. Surprisingly, a high percentage (19.8 percent) of operations last added ewes or ewe lambs to their flock 10 or more years ago.

a. Percentage of operations by number of years since ewes or ewe lambs were last added to the flock (other than births), by primary flock type:

Percent Operations								
Primary Flock Type								
Number Years	Herded/Open Range		Fenced Range		Farm Flock		All Operations*	
	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
Less than 1	22.6	(3.7)	29.1	(5.3)	35.3	(2.8)	34.1	(2.4)
1 to 2	28.7	(6.0)	12.7	(3.0)	17.7	(2.4)	17.0	(1.9)
3 to 9	25.6	(5.3)	28.6	(4.9)	29.6	(2.6)	29.1	(2.2)
10 or more	23.1	(3.9)	29.6	(5.4)	17.4	(2.2)	19.8	(2.0)
Total	100.0		100.0		100.0		100.0	

\*Includes operations that were classified as primarily feedlots (see p.4, Primary Flock Type).



While 28.7 percent of all operations that added ewes or ewe lambs during the previous 12 months added ewe lambs that were, on average, less than 8 months old, only 3.3 percent of herded/open range flocks did so. The majority (41.4 percent) of operations added ewes that were, on average, between 8 months and 35 months of age.

i. For operations that added ewes or ewe lambs in the last 12 months, percentage of operations by average age (in months) of ewes added, and by primary flock type:

Percent Operations								
Primary Flock Type								
Average Age (Months)	Herded/Open Range		Fenced Range		Farm Flock		All Operations*	
	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
Less than 8	3.3	(2.0)	33.1	(11.2)	28.7	(4.4)	28.7	(4.0)
8 to 35	49.0	(8.1)	39.3	(11.1)	40.8	(4.8)	41.4	(4.3)
36 to 59	39.1	(7.8)	18.0	(5.7)	24.2	(4.3)	23.1	(3.6)
60 or more	8.6	(4.2)	9.6	(3.9)	6.3	(1.8)	6.8	(1.6)
Total	100.0		100.0		100.0		100.0	

\*Includes operations that were classified as primarily feedlots (see p.4, Primary Flock Type).

Just over half (57.0 percent) of operations added rams during the previous 12 months.

b. Percentage of operations by number of years since last added rams (other than births) and by primary flock type:

Percent Operations							
Number Years	Primary Flock Type						
	Herded/Open Range		Fenced Range		Farm Flock		All Operations*
	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent Std. Error
Less than 1	73.9	(4.6)	57.5	(5.6)	56.7	(2.9)	57.0 (2.5)
1 to 4	20.4	(4.4)	34.1	(5.6)	38.4	(2.9)	37.4 (2.5)
5 or more	5.7	(2.3)	8.4	(3.4)	4.9	(1.0)	5.6 (1.1)
Total	100.0		100.0		100.0		100.0

\*Includes operations that were classified as primarily feedlots (see p.4, Primary Flock Type).

A closed flock is one in which neither rams nor ewes have been added for a period of time. While many operations may not have added ewes to their flock for a number of years, many did add rams (see tables 4a and 4b). Adding animals, whether rams or ewes, increases the risk of disease introduction. Only 4.3 percent of operations had not added either rams or ewes for 5 or more years.

c. Percentage of operations by number of years since last added **either** rams or ewes (other than births) and by primary flock type:

Percent Operations								
Primary Flock Type								
Number Years	Herded/Open Range		Fenced Range		Farm Flock		All Operations*	
	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
Less than 1	78.3	(4.5)	63.2	(5.7)	66.9	(2.7)	66.5	(2.4)
1 to 4	18.7	(4.2)	30.8	(5.5)	29.2	(2.7)	29.2	(2.4)
5 or more	3.0	(2.0)	6.0	(3.1)	3.9	(3.9)	4.3	(1.0)
Total	100.0		100.0		100.0		100.0	

\*Includes operations that were classified as primarily feedlots (see p.4, Primary Flock Type).

## 5. Biosecurity

Overall, 50.6 percent of operations reported that during 2000 their sheep had some contact with sheep from another operation. Sheep "leaving the operation for shows, exhibitions, or breeding and returning to the operation" was the most common category for contact with other sheep (32.4 percent of operations).

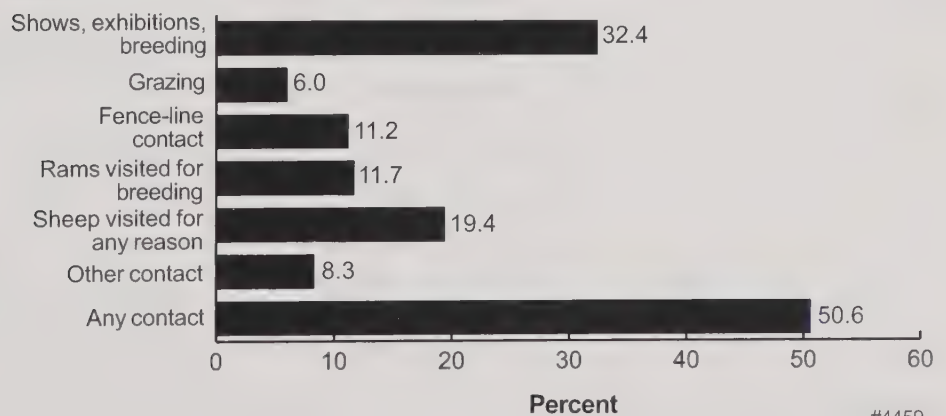


a. Percentage of operations where sheep had contact with sheep from another operation during 2000, by reason of contact:

Reason for Contact	Percent Operations	Standard Error
Sheep left operation for shows, exhibitions, or breeding then returned	32.4	(2.3)
Grazed sheep with flocks from another operation	6.0	(1.1)
Sheep were in fence-line contact with flocks from another operation	11.2	(1.1)
Temporarily brought rams onto operation for breeding purposes	11.7	(1.6)
Sheep from another operation visited for any reason, such as shearing or breeding	19.4	(1.8)
Other contact with sheep from another operation	8.3	(1.3)
Any contact listed above	50.6	(2.4)

**Percent of Operations Where Contact with Sheep from Another Operation Occurred During 2000, by Reason for Contact**

**Reason**



Only 28.7 percent of operations whose sheep had contact with sheep from another operation during 2000 attempted to decrease nose-to-nose contact with other sheep.

i. For operations where sheep had contact with sheep from another operation, percentage of operations that made an effort to decrease nose-to-nose contact with other sheep, by primary flock type:

Percent Operations							
Primary Flock Type							
Herded/Open Range		Fenced Range		Farm Flock		All Operations*	
Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
20.4	(4.4)	19.6	(4.1)	30.8	(3.6)	28.7	(3.0)

\*Includes operations that were classified as primarily feedlots (see p.4, Primary Flock Type).

Overall, 96.5 percent of operations had outdoor cats on-site. This varied little by flock type.

b. Percentage of operations where outdoor cats, including domestic, stray, or wildcats (i.e., bobcats) were present on the operation during 2000, by primary flock type:

Percent Operations							
Primary Flock Type							
Herded/Open Range		Fenced Range		Farm Flock		All Operations*	
Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
92.2	(1.8)	96.9	(2.2)	96.4	(1.0)	96.5	(0.9)

\*Includes operations that were classified as primarily feedlots (see p.4, Primary Flock Type).

The majority (74.1 percent) of operations with outdoor cats had personnel that worked with sheep and also handled or fed cats (table b.i.) On operations where cats were present, 90.1 percent reported that cats had access to stored hay; 87.7 percent reported that cats had access to an enclosed sheep facility; and 47.0 percent reported that cats had access to stored grain (table b.ii.). Allowing outdoor cats access to stored hay and grain may increase the risk of ewes becoming newly infected with *toxoplasma gondii*, which is an economically important cause of abortions in ewes.

i. For operations with outdoor cats present, percentage of operations where personnel working with sheep or sheep feed handled or fed these cats:

Handled or Fed Cats	Percent Operations	Standard Error
Yes	74.1	(2.2)
Don't know	2.3	(1.0)
No	23.6	(2.0)
Total	100.0	

ii. For operations with outdoor cats present, percentage of operations where the cats had access to the following:

Access	Percent Operations	Standard Error
Stored hay	90.1	(1.4)
Stored grain	47.0	(2.4)
Enclosed sheep facility	87.7	(1.5)

Cats were the predominant method of rat and mouse control, with 82.1 percent of operations indicating that cats were used for rodent control in 2000. Bait and/or poison was the second most common method (56.6 percent of operations).

c. Percentage of operations by methods used to control rats and mice during 2000:

Method	Percent Operations	Standard Error
Cats	82.1	(1.8)
Dogs	28.9	(2.2)
Traps	19.2	(1.9)
Bait and/or poison	56.6	(2.4)
Professional exterminator	0.9	(0.3)
Other controls	2.3	(0.6)
Any method	96.5	(0.7)

Overall, 45.0 percent of operations used either llamas, alpacas, donkeys, or dogs as guard animals to protect their sheep. Dogs were the animals used most commonly (29.6 percent of operations). Herded/open range flocks had the highest percentage (82.3 percent) of operations that used guard animals.



d. Percentage of operations that used the following animals as guards for their sheep:

Percent Operations								
Primary Flock Type								
Animals	Herded/Open Range		Fenced Range		Farm Flock		All Operations*	
	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
Llamas	25.5	(5.3)	16.4	(3.2)	13.4	(1.7)	14.2	(1.5)
Alpacas	0.0	(—)	0.0	(—)	0.1	(0.1)	0.1	(0.1)
Donkeys	9.0	(4.3)	16.4	(3.6)	10.2	(1.9)	11.4	(1.6)
Dogs	60.8	(5.8)	27.4	(4.5)	29.5	(2.6)	29.6	(2.2)
Any of the above	82.3	(4.3)	47.3	(5.2)	43.7	(2.7)	45.0	(2.4)

\*Includes operations that were classified as primarily feedlots (see p.4, Primary Flock Type).

Biosecurity measures are an important means of reducing or controlling the spread of infectious disease. For example, some infectious agents can be spread from one operation to another via footwear. Overall, 84.3 percent of operations allowed visitors access to sheep raising areas during 2000.

e. Percentage of operations that allowed visitors access to sheep raising areas, by primary flock type:

Percent Operations								
Primary Flock Type								
	Herded/Open Range		Fenced Range		Farm Flock		All Operations*	
	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
	80.7	(5.7)	83.6	(3.2)	85.0	(2.0)	84.3	(1.7)

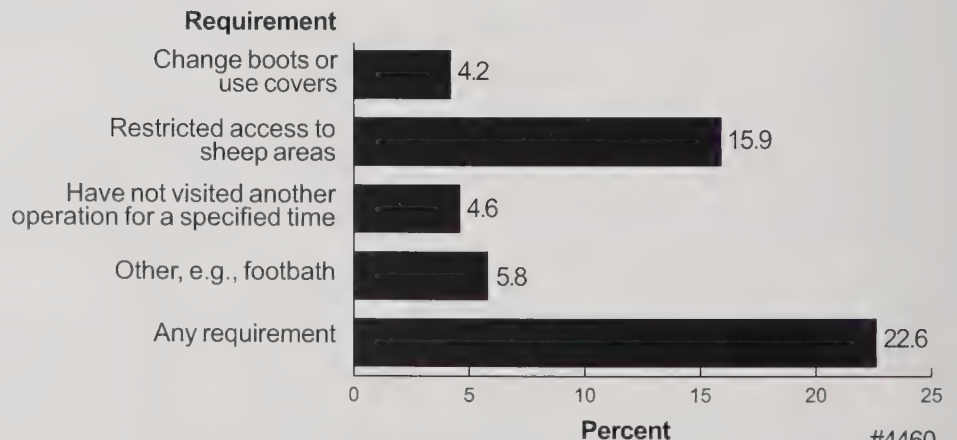
\*Includes operations that were classified as primarily feedlots (see p.4, Primary Flock Type).

On operations that allowed visitors, only 22.6 percent had any biosecurity requirements for visitors. The biosecurity requirement most common on operations that allowed visitors was to restrict access to certain sheep raising areas (15.9 percent of operations). The second most common biosecurity requirement was "other," e.g., footbaths or other methods of cleaning boots (5.8 percent of operations).

i. For operations that allowed visitors, percentage of operations by biosecurity requirements for visitors accessing sheep areas:

Requirement	Percent Operations	Standard Error
Change boots or use boot covers	4.2	(0.8)
Restricted access to certain sheep raising areas	15.9	(2.0)
Required that visitors have not been on a sheep operation for a specified time period	4.6	(0.9)
Other requirements	5.8	(1.4)
Any requirements	22.6	(2.2)

**For Operations that Allowed Visitors, Percent of Operations by Biosecurity Requirements for Accessing Sheep Areas**



#4460

## 6. Surface Moisture

As expected, a higher percentage (82.3 percent) of operations reported the surface moisture on the ground or flooring that ewes stand on as “usually dry” in summer compared to winter (48.8 percent of operations). The Pacific region had the highest percentage of operations that described the ground or flooring as “usually wet” in both winter and summer (55.5 percent and 6.5 percent, respectively).

a. Percentage of operations by characterization/description of surface moisture on the ground or flooring that ewes stand on most of the time during winter and summer, and by region:

Percent Operations										
	Region									
	Pacific		West Central		Central		Eastern		All Operations	
	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
<b>Winter</b>										
Usually dry	10.9	(4.0)	62.5	(4.0)	52.0	(3.9)	49.2	(5.5)	48.8	(2.4)
Wet about half the time	33.6	(4.6)	32.5	(4.0)	44.2	(3.9)	35.9	(5.5)	38.5	(2.3)
Usually wet	55.5	(5.6)	5.0	(1.2)	3.8	(1.3)	14.9	(3.9)	12.7	(1.5)
Total	100.0		100.0		100.0		100.0		100.0	
<b>Summer</b>										
Usually dry	77.1	(5.3)	90.1	(2.1)	82.0	(3.3)	72.9	(5.1)	82.3	(1.9)
Wet about half the time	16.4	(4.2)	9.4	(2.1)	16.9	(3.3)	23.5	(4.9)	15.7	(1.9)
Usually wet	6.5	(3.9)	0.5	(0.2)	1.1	(0.8)	3.6	(2.3)	2.0	(0.7)
Total	100.0		100.0		100.0		100.0		100.0	

## 7. Housing

In winter, 6.2 percent of operations provided fully enclosed housing for the majority of their flock. An additional 70.6 percent provided some sort of structure in winter. In summer, very few (0.5 percent) operations kept the majority of their flock in a fully enclosed structure. Over half (54.3 percent) of operations provided no housing structure during summer.

a. Percentage of operations by housing methods typically used for the majority of flock and by season:

Percent Operations				
Housing Method	Season			
	Winter		Summer	
	Percent	Standard Error	Percent	Standard Error
Fully enclosed	6.2	(1.3)	0.5	(0.3)
Enclosed structure (four sides and roof with large door open most of the time)	39.8	(2.4)	17.5	(1.9)
Open structure (one or more sides open)	30.8	(2.4)	27.7	(2.3)
No structure	23.2	(1.6)	54.3	(2.4)
Total	100.0		100.0	

i. Percentage of operations by housing method typically used for the majority of flock in winter, and by region:

Percent Operations								
Housing Method	Region							
	Pacific		West Central		Central		Eastern	
	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
Fully enclosed	2.2	(1.2)	1.0	(0.6)	8.4	(2.4)	13.0	(3.4)
Enclosed structure (four sides and roof with large door open most of the time)	32.4	(6.1)	12.4	(2.3)	54.3	(4.0)	51.4	(5.5)
Open structure (one or more sides open)	34.5	(5.9)	38.0	(4.4)	27.3	(3.8)	24.8	(5.1)
No structure	30.9	(4.7)	48.7	(4.0)	10.1	(1.8)	10.8	(2.7)
Total	100.0		100.0		100.0		100.0	



Most flock owners (87.5 percent first lambing and 91.8 percent second lambing) provided some kind of structure for their ewes during lambing season. The most common housing provided in the first or only lambing season (39.9 percent of operations) was an enclosed structure with a large door that was kept open most of the time. For the 29.3 percent of operations that had a second lambing season, 11.2 percent used a fully enclosed structure, while 28.0 percent had no structure. Regional differences were especially evident in the West Central region, where only 7.0 percent of operations had fully enclosed housing and 61.0 percent had no structure.

b. Percentage of operations by housing method typically used for the majority of flock, and by lambing season:

Housing Method	Percent Operations			
	Lambing Season			
	First (or Only)		Second (Operations with Second Lambing Season)	
	Percent	Standard Error	Percent	Standard Error
Fully enclosed	23.6	(2.0)	11.2	(2.5)
Enclosed structure (four sides and roof with large door open most of the time)	39.9	(2.3)	27.3	(3.7)
Open structure (one or more sides open)	24.0	(2.2)	33.5	(4.5)
No structure	12.5	(1.2)	28.0	(3.7)
Total	100.0		100.0	

### 8. Cleaning of lambing area

For 87.9 percent of operations that provided a structure for lambing, the majority (51.4 percent) cleaned the lambing area at the end of lambing season. This also was the most common period for cleaning the lambing area for herded/open range flocks (58.5 percent) and farm flocks (54.4 percent).

a. For operations with a structure for lambing, percentage of operations by frequency of cleaning manure and waste bedding from lambing areas during lambing, and by primary flock type:

Percent Operations								
Primary Flock Type								
Cleaning Frequency	Herded/Open Range		Fenced Range		Farm Flock		All Operations*	
	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
Never	7.3	(2.5)	16.9	(6.4)	6.1	(1.1)	7.6	(1.3)
Between each ewe	23.0	(5.2)	36.5	(8.0)	22.5	(2.4)	24.8	(2.4)
Between two or more ewes	11.2	(3.2)	12.8	(3.9)	17.0	(2.0)	16.2	(1.8)
At end of lambing season	58.5	(6.3)	33.8	(6.8)	54.4	(2.8)	51.4	(2.6)
Total	100.0		100.0		100.0		100.0	

\*Includes operations that were classified as primarily feedlots (see p.4, Primary Flock Type).

For operations that provided a structure for lambing, nearly 9 out of 10 (88.3 percent) moved ewes/lambs to a jug after lambing (a jug is an individual pen for ewes/lambs, used typically during lambing or soon after). This occurred most commonly in herded/open range flocks (98.2 percent), as compared to fenced range flocks (80.9 percent) and farm flocks (89.3 percent).

b. Percentage of operations that moved ewe/lambs to a jug after lambing, by primary flock type:

Percent Operations							
Primary Flock Type							
Herded/Open Range		Fenced Range		Farm Flock		All Operations*	
Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
98.2	(1.1)	80.9	(6.7)	89.3	(2.0)	88.3	(1.9)

\*Includes operations that were classified as primarily feedlots (see p.4, Primary Flock Type).

The two most common times for cleaning jugs were between each ewe (38.4 percent of operations) and at the end of lambing season (39.5 percent of operations). Only 3.7 percent of operations that used jugs never cleaned the jugs during lambing season. This was less than half the percentage of operations that never cleaned lambing areas during lambing season (table 8a).

i. For operations that moved ewe/lamb pairs to a jug after lambing, percentage of operations by frequency of cleaning manure and waste bedding from jug areas during lambing:

Cleaning Frequency	Percent Operations	Standard Error
Never	3.7	(1.1)
Between each ewe	38.4	(2.7)
Between two or more ewes	18.4	(1.9)
At end of lambing season	39.5	(2.7)

Using the same equipment to handle both feed and manure may result in fecal contamination of feed, which can transmit diseases such as Johne's. Only 12.7 percent of all operations ever used manure handling equipment to handle feed for lambs.

c. Percentage of operations where manure-handling equipment was **EVER** used to handle feed for lambs, by flock size:

Percent Operations							
Flock Size (Number of Ewes 1 Year or Older)							
Small (Less than 100)		Medium (100-499)		Large (500 or More)		All Operations	
Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
11.2	(1.7)	18.3	(2.2)	17.4	(2.3)	12.7	(1.4)

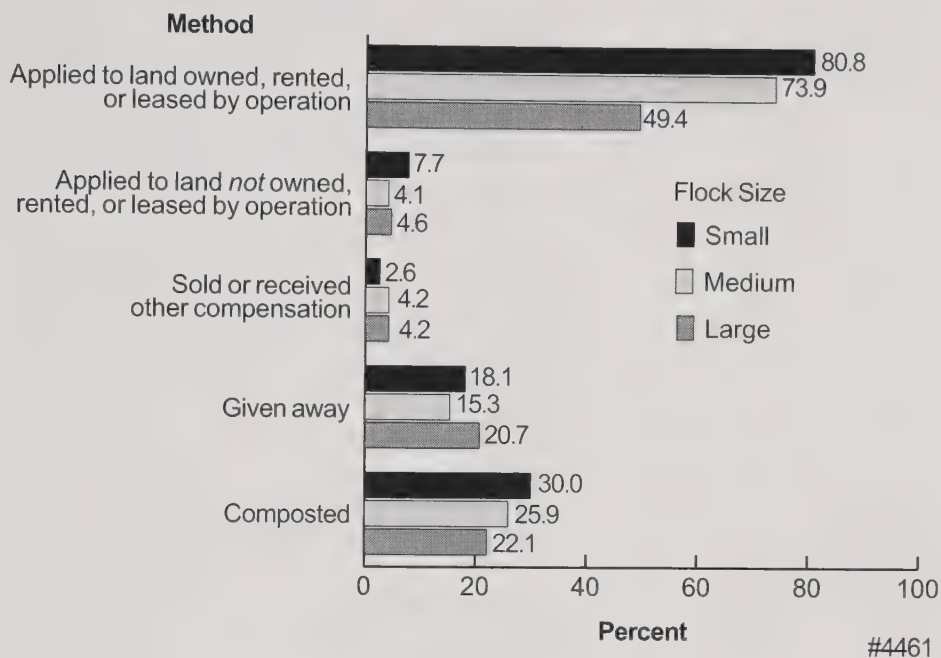
The most common method of manure disposal (78.2 percent of operations) was to apply manure to land owned, rented, or leased by the operation. This was true for small, medium, and large flocks (80.8 percent, 73.9 percent, and 49.4 percent, respectively), although the actual percentage decreased as flock size increased. Composting was the second most common method of manure disposal (29.0 percent of operations).

d. Percentage of operations by methods used to dispose of manure during 2000, by flock size:

Percent Operations								
Flock Size (Number of Ewes 1 Year or Older)								
Method	Small (Less than 100)		Medium (100-499)		Large (500 or More)		All Operations	
	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
Applied to land owned, rented, or leased by operation	80.8	(2.5)	73.9	(2.5)	49.4	(3.2)	78.2	(2.0)
Applied to land <i>not</i> owned, rented, or leased by operation	7.7	(1.7)	4.1	(0.9)	4.6	(1.1)	7.0	(1.3)
Sold or received other compensation	2.6	(0.8)	4.2	(0.9)	4.2	(1.1)	3.0	(0.6)
Given away	18.1	(2.2)	15.3	(1.8)	20.7	(3.3)	17.7	(1.8)
Composted	30.0	(2.7)	25.9	(2.3)	22.1	(2.3)	29.0	(2.2)



**Percent of Operations by Methods Used to Dispose of Manure During 2000, and by Flock Size**



**B. Reproduction Management**

**1. Estrous synchronization**

Only 7.4 percent of operations used estrous synchronization during 2000. Estrous synchronization was used most often by farm flocks (8.4 percent of operations).

a. Percentage of operations that used estrous synchronization during 2000, by primary flock type:

Percent Operations							
Primary Flock Type							
Herded/Open Range		Fenced Range		Farm Flock		All Operations*	
Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
2.2	(1.1)	4.1	(2.2)	8.4	(1.6)	7.4	(1.3)

\*Includes operations that were classified as primarily feedlots (see p.4, Primary Flock Type).

For operations that used estrous synchronization, more operations used a non-drug method (such as light or a teaser ram) than any other method. The majority of operations that reported using an “other method” for estrous synchronization used more than one product, such as pregnant mare’s serum gonadotropin and progestogen.

i. For operations that used estrous synchronization, percentage of operations by methods used:

Method	Percent Operations	Standard Error
Progestogen (i.e., MGA, Synchromate-B® or MAP)	44.6	(9.5)
Prostaglandin (i.e., Lutalyse® or Estrumate®)	9.3	(3.1)
Nondrug method (light or teaser ram)	57.6	(9.1)
Other method	18.9	(7.8)

“Other factors” was the most common reason for using estrous synchronization (32.1 percent of operations). The most common other factors reported for using estrous synchronization were artificial insemination and to ensure early lambs for shows/exhibitions (market timing).

ii. For operations that used estrous synchronization, percentage of operations by primary reason for use:

Reason	Percent Operations	Standard Error
Increase pregnancy rate	6.6	(4.0)
Increase number of lambs born	8.5	(6.7)
Market timing	14.6	(4.2)
More uniform lamb crop	17.6	(6.5)
More uniform breeding season	18.5	(7.3)
Availability of feed	0.0	(0.0)
More efficient use of labor and/or facilities	2.1	(1.2)
Other factors	32.1	(9.1)
Total	100.0	

The primary reason for not using estrous synchronization was "other factors" (45.2 percent of operations). Most of these operations saw no benefit to estrous synchronization and therefore did not use it.

iii. For operations that **did not** use estrous synchronization, percentage of operations by primary reason for **not** using estrous synchronization:

Reason	Percent Operations	Standard Error
Cost of system	17.2	(1.8)
Labor required	13.8	(1.6)
Lack of handling facilities	3.2	(0.7)
Too difficult/complicated	20.1	(2.1)
Availability of feed	0.5	(0.2)
Other factors	45.2	(2.5)
Total	100.0	

## 2. Out-of-season breeding

An unexpectedly high percentage (23.5 percent) of fenced range operations used out-of-season breeding during 2000. This reflects the high proportion of fenced range flocks located in Texas and California, where what might be considered out-of-season breeding (January through June) in other areas of the country are actually normal breeding months in Texas and California. Over half (65.0 percent) of fenced range flocks that used out-of-season breeding were located in Texas.

a. Percentage of operations that used out-of-season breeding during 2000, by primary flock type:

Percent Operations							
Primary Flock Type							
Herded/Open Range		Fenced Range		Farm Flock		All Operations*	
Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
1.0	(0.8)	23.5	(5.3)	15.9	(1.9)	17.5	(1.9)

\*Includes operations that were classified as primarily feedlots (see p.4, Primary Flock Type).



Overall, 97.3 percent of operations considered a lambing rate of 70 percent or more to be successful. For operations that used out-of-season breeding, nearly half (48.3 percent) required that at least 70 percent of bred ewes lambed (lambing rate) before the lambing rate was considered successful, while 27.6 percent of these operations considered a lambing rate of less than 50 percent to be successful.

i. Percentage of operations by minimum percentage of ewes lambing (lambing rate) considered to be successful:

Percent Ewes Lambing	Out-of-Season Breeding Operations		All Operations	
	Percent	Standard Error	Percent	Standard Error
Less than 50 percent	27.6	(5.2)	0.1	(0.1)
50 to 59 percent	13.6	(2.6)	1.3	(0.7)
60 to 69 percent	10.5	(4.6)	1.3	(0.5)
70 percent or more	48.3	(6.0)	97.3	(0.8)
Total	100.0		100.0	

For operations that used out-of-season breeding, most (62.2 percent) considered 1.5 to 2.0 lambs born per ewe indicative of a successful twinning rate, which was similar to the twinning-rate expectations for all operations (74.1 percent).

ii. Percentage of operations by minimum number of lambs born for all ewes lambing (twinning rate) considered successful:

Number Lambs per Ewe	Out-of-Season Breeding Operations		All Operations	
	Percent	Standard Error	Percent	Standard Error
Less than 1.5	28.6	(5.7)	21.3	(2.2)
1.5 to 2.0	62.2	(5.9)	74.1	(2.4)
More than 2.0	9.2	(3.0)	4.6	(1.0)
Total	100.0		100.0	

Most operations (62.3 percent) used out-of-season breeding to either increase the number of lambs born or to improve market timing.

iii. For operations that used out-of-season breeding, percentage of operations by primary reason for use:

Reason	Percent Operations	Standard Error
Increase pregnancy rate	1.3	(0.6)
Increase number of lambs born	32.1	(6.5)
Market timing	30.2	(4.7)
More uniform lamb crop	0.4	(0.2)
More uniform breeding season	0.4	(0.2)
Availability of feed	0.6	(0.3)
More efficient use of labor and/or facilities	12.7	(5.0)
Other factors	22.3	(5.9)
Total	100.0	

“Other factors” was the most common reason operations gave for not using out-of-season breeding. Half of these operations saw no value in out-of-season breeding. The second most common reason for not using out-of-season breeding was that it was “too difficult or complicated.”

b. For operations that **did not** use out-of-season breeding, percentage of operations by primary reasons for **not** using out-of-season breeding

Reason	Percent Operations	Standard Error
Cost of system	5.4	(1.0)
Labor required	16.7	(1.8)
Lack of handling facilities	4.2	(1.1)
Too difficult/complicated	22.8	(2.3)
Availability of feed	2.6	(0.6)
Other factors	48.3	(2.7)
Total	100.0	

### 3. Lambing month and preference

More operations (34.0 percent) reported that the majority of lambs were born in February than in any other month. For these operations, 40.1 percent would, if possible, change the month lambs were born. Operations that lamb in October were least likely to want to change lambing months. If operations were able to choose the most desirable month lambs were born, there would be fewer operations lambing in February (23.4 percent versus 34.0 percent) and more operations lambing in October (5.6 percent versus 2.3 percent). The most desirable month is defined as: operations that lamb in a particular month and would not change the month lambs were born, plus operations that do not currently lamb in that month but would change to that month if they could.

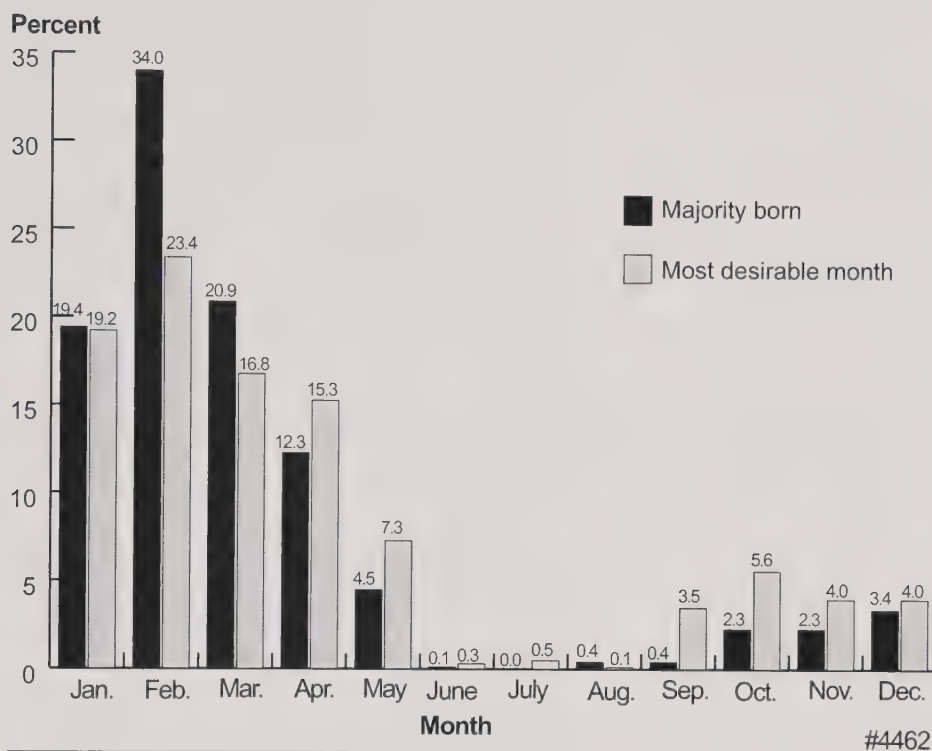
a. Percentage of operations by month the majority of lambs were born and (for these operations) percentage that, if possible, would change the month (to a more preferable time) the majority of lambs were born, and by most desirable month majority of lambs would be born if it were possible to change the lambing month:

Percent Operations						
Month**	Current Month	Standard Error	Would Change	Standard Error	Most Desirable Month	Standard Error
January	19.4	(2.0)	30.0	(5.6)	19.2	(1.9)
February	34.0	(2.4)	40.1	(4.3)	23.4	(2.2)
March	20.9	(1.9)	39.1	(5.2)	16.8	(1.7)
April	12.3	(1.5)	12.7	(4.1)	15.3	(1.7)
May	4.5	(0.7)	14.5	(3.6)	7.3	(1.3)
June	0.1	(0.0)	*	(*)	0.3	(0.1)
July	0.0	(0.0)	*	(*)	0.5	(0.4)
August	0.4	(0.4)	*	(*)	0.1	(0.0)
September	0.4	(0.3)	*	(*)	3.5	(1.0)
October	2.3	(0.6)	3.5	(2.3)	5.6	(1.2)
November	2.3	(0.4)	23.7	(7.1)	4.0	(0.6)
December	3.4	(0.9)	46.0	(14.5)	4.0	(0.8)
Total	100.0				100.0	

\* Too few respondents to report estimates. \*\* Month majority of lambs born



### Percent of Operations by Current Month the Majority of Lambs were Born, and by Most Desirable Month



## C. Lambing Management

### 1. Placenta removal and disposal

Overall, 75.2 percent of operations removed placentas from pens or lambing areas. More farm flocks (81.0 percent) removed placentas than either herded/open range flocks (49.3 percent) or fenced range flocks (55.5 percent).

a. Percentage of operations that usually removed placentas from pens or lambing areas, by primary flock type:

Percent Operations							
Primary Flock Type							
Herded/Open Range		Fenced Range		Farm Flock		All Operations*	
Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
49.3	(5.4)	55.5	(5.1)	81.0	(2.0)	75.2	(1.9)

\*Includes operations that were classified as primarily feedlots (see p.4, Primary Flock Type).

Composting was the most common method for disposing of placentas (29.4 percent of operations). Many operations (13.1 percent) disposed of placentas in other ways, usually by putting them in a manure pile or throwing them in a field.

i. For operations that removed placentas from pens or lambing areas, percentage of operations by usual method of placenta disposal:

Method of Disposal	Percent Operations	Standard Error
Burn/incinerate	12.7	(1.8)
Bury	11.2	(1.5)
Render	0.3	(0.3)
Landfill/dump	17.9	(2.4)
Compost	29.4	(2.7)
Carnivores	15.4	(2.1)
Other	13.1	(2.0)
Total	100.0	

In general, operations removed placentas from pens or lambing areas in less than 6 hours after birth (68.4 percent of operations).

ii. For operations that removed placentas from pens or lambing areas, percentage of operations by average time placentas are left on the ground before disposal:

Time Left on Ground	Percent Operations	Standard Error
Less than 6 hours	68.4	(2.7)
6 to 12 hours	23.7	(2.5)
More than 12 hours	7.9	(1.6)
Total	100.0	

## 2. Shear or crutch ewes

As operation size increased so did the percentage of operations that sheared ewes entirely or crutched (shearing ewes in the perianal and udder areas) them within 6 weeks of lambing. Overall, 63.3 percent of operations sheared ewes entirely or crutched ewes within 6 weeks of lambing.

a. Percentage of operations that sheared ewes entirely or crutched ewes within 6 weeks of lambing during 2000, by flock size:

Percent Operations							
Flock Size (Number of Ewes 1 Year or Older)							
Small (Less than 100)		Medium (100-499)		Large (500 or More)		All Operations*	
Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
60.9	(2.9)	69.8	(2.5)	80.3	(2.4)	63.3	(2.3)

\*Includes operations that were classified as primarily feedlots (see p. 4, Primary Flock Type).

i. Percentage of operations that sheared ewes entirely or crutched ewes within 6 weeks of lambing during 2000, by primary flock type:

Percent Operations					
Primary Flock Type					
Herded/Open Range		Fenced Range		Farm Flock	
Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
80.3	(6.0)	62.6	(5.4)	63.4	(2.7)

### 3. Abortion

At least 50.6 percent of all operations had ewes abort in the last 3 years.

a. Percentage of operations that had any ewes abort in the last 3 years, by primary flock type:

Percent Operations								
Primary Flock Type								
Herded/Open Range			Fenced Range		Farm Flock		All Operations*	
Aborted	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
Yes	61.9	(6.3)	41.1	(5.2)	52.4	(2.8)	50.6	(2.4)
No	17.3	(6.7)	35.1	(5.9)	38.6	(2.8)	37.3	(2.5)
Don't know	20.8	(4.6)	23.8	(3.6)	9.0	(1.5)	12.1	(1.4)
Total	100.0		100.0		100.0		100.0	

\*Includes operations that were classified as primarily feedlots (see p.4, Primary Flock Type).

Removing placentas and fetuses from the lambing area, and removing aborting ewes from the flock, is important because placentas, fetuses, and aborting ewes can be a source of infection. Nearly 9 out of 10 operations (88.8 percent) removed placentas or fetuses from the lambing area as soon as possible. Only 44.1 percent of operations physically separated aborting ewes or ewes that had aborted from lambing ewes or replacement ewe lambs.

i. For operations that had abortions within the last 3 years, percentage of operations by usual management practice regarding abortions or aborting ewes:

Usual Practice	Percent Operations	Standard Error
Remove placentas or fetuses from area as soon as possible	88.8	(1.7)
Physically separate aborting ewes or ewes that have aborted from lambing or replacement ewes	44.1	(3.1)
Clean the area by removing bedding and/or dirt	41.2	(3.2)
Disinfect area	20.8	(2.9)

For operations that physically separated aborting ewes, over half (53.8 percent) separated ewes for 14 days or less. Only a small percentage (9.5 percent) of operations never returned aborting ewes to the flock.

ii. For operations that physically separated aborting ewes, percentage of operations by number of days separated:

Number of Days	Percent Operations	Standard Error
1 to 7	25.8	(4.0)
8 to 14	28.0	(5.1)
15 to 30	18.2	(4.5)
31 to 60	8.1	(2.6)
61 or more	10.4	(2.8)
Never returned to flock	9.5	(2.0)
Total	100.0	



For operations that had abortions within the previous 3 years, 8.8 percent reported the cause was campylobacteriosis; 53.7 percent of these operations had this diagnosis confirmed by either a veterinarian or laboratory. Nearly one-fourth (24.3 percent) of operations reported that abortions were caused by an infectious agent; 51.3 percent of these operations had a veterinarian or laboratory confirm the diagnosis.

iii. For operations that had abortions within the last 3 years, percentage of operations by cause of abortions in the last 3 years, and percentage of operations where the diagnosis was made by either a veterinarian or lab:

Percent Operations				
Cause of Abortions	Abortions in Last 3 years		Cause Diagnosed by Vet or Lab	
	Percent	Standard Error	Percent	Standard Error
Campylobacteriosis (vibrio abortion)	8.8	(1.6)	53.7	(9.7)
Chlamydiosis (enzootic abortion)	8.5	(1.8)	43.6	(11.0)
Toxoplasmosis	6.0	(1.9)	26.2	(10.0)
Q fever	1.0	(0.8)	91.6	(9.8)
Salmonellosis	0.3	(0.1)	76.8	(13.1)
Listeriosis	1.5	(1.0)	82.0	(14.4)
Other known infectious cause	5.6	(2.1)	73.3	(14.3)
Any infectious cause above	24.3	(3.0)	51.3	(7.4)

**4. Management practices compared to 3 years previously**

a. Percentage of operations that were raising sheep 3 years prior to study:

Percent Operations	Standard Error
98.0	(1.1)

In general, lambing practices changed little between the time of the study and 3 years previously. It was important to evaluate current lambing practices and those of 3 years earlier because of the possible associations between lambing management and Johne's infection. Since Johne's is a chronic disease, lambing management practices in earlier years may have contributed to its spread.

b. Percentage of operations by lambing practices, at the time of study and 3 years previously:

Lambing Practice	Percent Operations			
	At Time of Study		3 Years Previously	
	Percent	Std. Error	Percent	Std. Error
Separated new additions of bred ewes from flock until they lamb <sup>*</sup>	14.3	(2.6)	18.3	(2.7)
Used lambing area as a sick ewe pen during lambing	23.0	(2.1)	23.5	(2.1)
Used lambing area as a sick ewe pen during other times of year	32.3	(2.3)	31.4	(2.2)
Separated ewes and /or lambs pregnant for the first time from ewes that had more than one full-term birth <sup>**</sup>	19.9	(1.8)	20.0	(2.7)
Provided lambs with colostrum from source other than mother	63.6	(2.3)	63.8	(2.3)
Supplemented with milk or milk replacer (except for fostering)	57.5	(2.4)	59.3	(2.3)

\*Includes only those operations that added bred ewes.

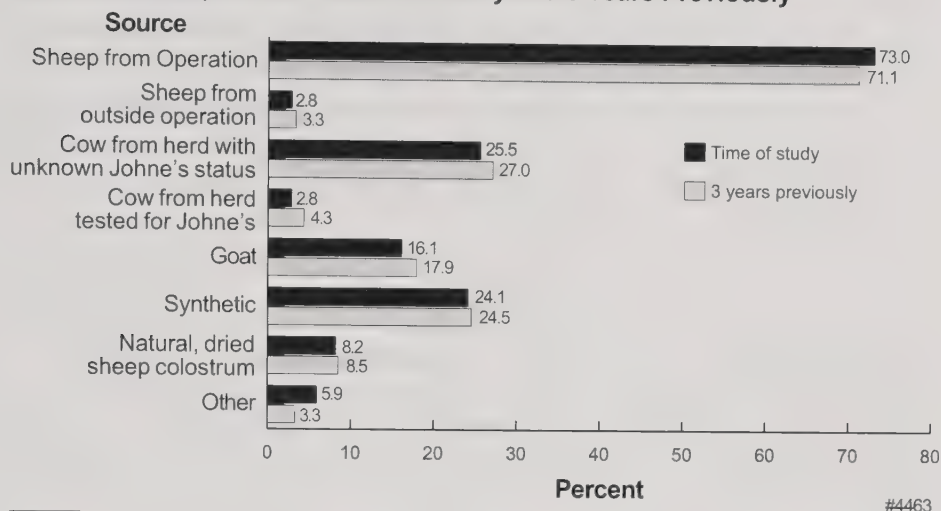
\*\*Includes only those operations with first-pregnancy ewes.

When lambs were provided colostrum from a source other than the mother, they were given most commonly colostrum from other sheep on the operation (73.0 percent of operations). The second and third most common sources of colostrum were cows from herds with unknown Johne's status (25.5 percent of operations) and synthetic colostrum (24.1 percent of operations). These three also were the top sources of colostrum 3 years previously.

i. For operations that provided lambs with colostrum from a source other than mother, percentage of operations that used the following colostrum sources, at the time of the study and 3 years previously:

	Percent Operations			
	At Time of Study		3 Years Previously	
Colostrum Source	Percent	Std. Error	Percent	Std. Error
Sheep from operation	73.0	(2.8)	71.1	(2.8)
Sheep from outside operation	2.8	(1.0)	3.3	(1.2)
Cow from herd with unknown Johne's status	25.5	(2.7)	27.0	(2.5)
Cow from herd tested for Johne's	2.8	(0.9)	4.3	(1.5)
Goat	16.1	(2.3)	17.9	(2.4)
Synthetic	24.1	(2.7)	24.5	(2.6)
Natural, dried sheep colostrum	8.2	(1.4)	8.5	(1.4)
Other	5.9	(1.9)	3.3	(0.9)

**Percent of Operations that used the Following Colostrum Sources (Other than the Mother) at the Time of the Study and 3 Years Previously**



For operations that provided lambs with supplemental milk, 90.8 percent used milk replacer, followed by milk from sheep on the operation (33.9 percent of operations), and goat milk (13.2 percent of operations). These were the same top three sources of milk used 3 years previously.

c. For operations that provided lambs with supplemental milk (except for fostering), percentage of operations that used the following milk sources, at the time of the study and 3 years previously:

Supplemental Milk Source	Percent Operations			
	At Time of Study		3 Years Previously	
	Percent	Std. Error	Percent	Std. Error
Sheep from operation	33.9	(2.9)	31.2	(2.8)
Sheep from outside operation	0.2	(0.1)	0.6	(0.4)
Cow from herd with unknown Johne's status	7.8	(1.5)	9.4	(1.9)
Cow from herd tested for Johne's	1.3	(0.7)	2.2	(1.4)
Goat	13.2	(2.1)	14.8	(2.4)
Milk replacer	90.8	(1.8)	89.5	(2.2)
Other	4.0	(1.7)	4.2	(1.7)

Only 3.5 percent of operations used pasteurized supplemental milk (other than milk replacer) at the time of the study, and a similar percentage (3.8 percent of operations) used pasteurized supplemental milk 3 years previously.

i. For operations that provided lambs with supplemental milk (except for fostering), percentage of operations that used **pasteurized** supplemental milk (other than milk replacer), at the time of the study and 3 years previously:

Percent Operations			
At Time of Study		3 Years Previously	
Percent	Standard Error	Percent	Standard Error
3.5	(1.2)	3.8	(1.2)

## 5. Tail docking

Overall, 95.9 percent of operations docked their lambs' tails during 2000. Just over three-quarters (76.8 percent) of operations docked their lambs' tails either at the caudal fold (55.4 percent) or longer than the caudal fold (21.4 percent).

a. Percentage of operations that docked tails, by length of the majority of lambs' tails after docking:

Length of Tail After Docking	Percent Operations	Standard Error
Shorter than caudal fold (V-shaped bare skin under the tail)	19.1	(2.0)
At caudal fold	55.4	(2.4)
Longer than caudal fold	21.4	(1.9)
No tails docked	4.1	(0.9)
Total	100.0	



## D. Health Management

### 1. Culling

Overall, 16.6 percent of ewes died or were culled during 2000.

a. Percentage of ewes<sup>1</sup> that died or were culled during 2000, by primary flock type:

Percent Ewes							
Primary Flock Type							
Herded/Open Range		Fenced Range		Farm Flock		All Operations*	
Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
15.1	(0.7)	16.5	(0.7)	17.8	(0.9)	16.6	(0.5)

\*Includes operations that were classified as primarily feedlots (see p.4, Primary Flock Type).

<sup>1</sup> Ewes 1 year or older that died or were culled during 2000 as a percentage of January 1, 2001, ewe inventory.

Of the ewes that died or were culled during 2000, 10.4 percent were culled or died with progressive weight loss, despite having a normal appetite and no respiratory problems.

i. For ewes that died or were culled, percentage culled or died with the following specific combination of signs:

Signs	Percent Culled or Died	Standard Error
Progressive weight loss with normal appetite and no respiratory problems	10.4	(1.2)
Labored breathing (may tire easily or trail flock mates) WITH progressive weight loss and normal appetite	3.3	(0.3)
Neurological signs (e.g., coordination loss, gait abnormalities, severe itching or rubbing) with or without progressive weight loss with normal appetite	0.4	(0.1)

## 2. Johne's Disease

The majority (79.3 percent) of operations would allow a pregnant ewe with weight loss and a normal appetite to lamb, even if it did not respond to treatment, then reevaluate or cull her after lambing. Very few operations (12.3 percent) would cull a ewe with the above signs prior to lambing. These management practices varied little by flock type.

a. Percentage of operations by the health management practice that best describes what would most likely be done if a pregnant ewe demonstrated weight loss with a normal appetite and did not respond to treatment, and by primary flock type:

Percent Operations								
Primary Flock Type								
Practice	Herded/Open Range		Fenced Range		Farm Flock		All Operations*	
	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
Cull before lambing	16.3	(2.9)	17.8	(3.8)	10.9	(1.4)	12.3	(1.3)
Allow lambing, then reevaluate ewe or cull her	77.4	(3.5)	71.7	(4.4)	81.1	(2.1)	79.3	(1.8)
Keep ewe regardless of described signs	6.3	(1.9)	10.5	(2.4)	8.0	(1.8)	8.4	(1.4)
Total	100.0		100.0		100.0		100.0	

\*Includes operations that were classified as primarily feedlots (see p.4, Primary Flock Type).

Nearly one-third (30.2 percent) of sheep producers had never heard of Johne's disease before participating in the NAHMS sheep study. The West Central region had the greatest percentage (44.8 percent) of producers who had never heard of Johne's.

b. Percentage of operations by familiarity with Johne's disease (paratuberculosis) before the study, and by region:

Percent Operations										
Familiarity	Region									
	Pacific		West Central		Central		Eastern		All Operations	
	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
Very familiar	9.4	(3.6)	3.1	(2.0)	7.6	(1.9)	6.4	(1.7)	6.5	(1.1)
Somewhat familiar	25.9	(5.2)	19.5	(3.2)	27.4	(3.8)	29.1	(4.9)	25.3	(2.2)
Heard of name only	38.7	(6.1)	32.6	(3.5)	40.0	(3.8)	40.9	(5.5)	38.0	(2.3)
Never heard of	26.0	(4.8)	44.8	(4.1)	25.0	(3.5)	23.6	(4.8)	30.2	(2.2)
Total	100.0		100.0		100.0		100.0		100.0	

Half (50.9 percent) the producers who had, at the very least, heard of Johne's disease were moderately to highly concerned about the disease.

i. For operations that were very familiar, somewhat familiar, or had heard of Johne's disease, percentage of operations by level of concern<sup>1</sup> about Johne's disease:

Level of Concern	Percent Operations	Standard Error
Not concerned	19.2	(2.0)
Little concerned	29.9	(2.6)
Moderately concerned	32.6	(2.7)
Highly concerned	18.3	(2.4)
Total	100.0	

<sup>1</sup> The specific question included "Answer this from the standpoint of overall potential effects on your flock and customers, regardless of whether this disease exists in your flock."

While half the producers who had, at the very least, heard of Johne's disease were concerned about the disease, only 7.4 percent had a flock health management program to control or prevent it. Very few operations acquired ewes (0.8 percent of operations) or rams (4.7 percent of operations) from flocks known to have tested negative for Johne's.

ii. For operations that were very familiar, somewhat familiar, or had heard of Johne's disease, percentage of operations that had a flock health management program to control or prevent Johne's, by region:

Percent Operations									
Region									
Pacific		West Central		Central		Eastern		All Operations	
Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
4.9	(1.7)	3.4	(1.4)	10.0	(3.3)	6.5	(2.1)	7.4	(1.7)

iii. For operations that were very familiar, somewhat familiar, or had heard of Johne's disease, percentage of operations that had a flock health management program to control or prevent Johne's, by flock size:

Percent Operations					
Flock Size (Number Ewes 1 Year or Older)					
Less than 100		100-499		500 or more	
Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
7.4	(2.2)	8.1	(1.8)	4.4	(1.2)

iv. For operations that were very familiar, somewhat familiar, or had heard of Johne's disease, **and** had acquired either ewes or rams, percentage of operations by frequency that newly acquired breeding sheep (ewes and/or rams) were obtained during 2000 from a flock known to have tested negative for Johne's:

Frequency	Ewes		Rams	
	Percent Operations	Std. Error	Percent Operations	Std. Error
All ewes and rams	0.7	(0.3)	3.9	(1.2)
Some ewes and/or rams	0.1	(0.1)	0.8	(0.5)
Either no ewes or no rams	35.9	(5.0)	24.2	(3.3)
Did not know	63.3	(5.0)	71.1	(3.4)
Total	100.0		100.0	



### 3. Scrapie

Overall, 92.6 percent of operations had, at the very least, heard of scrapie. A higher percentage of producers in the Pacific region (96.6 percent) and Central region (96.7 percent) were aware of scrapie at some level compared to producers in the West Central region (85.9 percent) and Eastern region (87.4 percent).

a. Percentage of operations by familiarity with scrapie before this study, and by region:

Percent Operations					
Familiarity	Region				
	Pacific	West Central	Central	Eastern	All Operations
	Std. Pct. Error	Std. Pct. Error	Std. Pct. Error	Std. Pct. Error	Std. Pct. Error
Very familiar	22.9 (4.1)	12.2 (2.6)	22.1 (3.4)	21.3 (4.1)	19.5 (1.9)
Somewhat familiar	47.9 (6.0)	46.7 (4.0)	43.1 (3.9)	42.3 (5.4)	44.6 (2.4)
Heard of name only	25.8 (5.7)	27.0 (3.1)	31.5 (3.8)	23.8 (4.9)	28.5 (2.2)
Never heard of	3.4 (1.4)	14.1 (3.4)	3.3 (1.1)	12.6 (4.1)	7.4 (1.2)
Total	100.0	100.0	100.0	100.0	100.0

For producers who had, at the very least, heard of scrapie, 66.9 percent were either moderately or highly concerned about the disease.

i. For operations that were very familiar, somewhat familiar, or had heard of scrapie, percentage of operations by level of concern<sup>1</sup> about scrapie:

Level of Concern	Percent Operations	Standard Error
Not concerned	12.1	(1.6)
Little concerned	21.0	(1.8)
Moderately concerned	36.2	(2.4)
Highly concerned	30.7	(2.3)
Total	100.0	

<sup>1</sup>The specific question included "Answer this from the standpoint of overall potential effects on your flock and customers, regardless of whether this disease exists in your flock."

For producers who had, at the very least, heard of scrapie, only 3.4 percent were participating in the National Scrapie Flock Certification Program, and nearly half (49.8 percent) had not heard of the program at the time of the study.

ii. For operations that were very familiar, somewhat familiar, or had heard of scrapie, percentage of operations by option that best describes participation in the National Scrapie Flock Certification Program, and by region:

Percent Operations					
Familiarity	Region				
	Pacific	West Central	Central	Eastern	All Operations
	Std. Pct. Error	Std. Pct. Error	Std. Pct. Error	Std. Pct. Error	Std. Pct. Error
Currently participate in program	4.7 (1.3)	4.7 (2.3)	1.4 (0.5)	7.0 (3.2)	3.4 (0.8)
Know of program but do not participate	47.8 (6.1)	38.2 (4.2)	48.5 (4.0)	55.8 (5.8)	46.8 (2.5)
Do not know of program, but might participate if did	33.1 (6.4)	33.3 (3.6)	30.2 (3.8)	28.3 (5.3)	31.1 (2.3)
Do not know of program, and not interested in participating	14.4 (4.0)	23.8 (3.4)	19.9 (3.0)	8.9 (3.4)	18.7 (1.8)
Total	100.0	100.0	100.0	100.0	100.0

iii. For operations that were very familiar, somewhat familiar, or had heard of scrapie, percentage of operations by option that best describes participation in the National Scrapie Flock Certification Program, and by flock size:

Participation Option	Percent Operations					
	Flock Size (Number of Ewes 1 Year or Older)					
	Small		Medium		Large	
	(Less than 100)		(100-499)		(500 or More)	
	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
Currently participate in program	3.5	(1.0)	2.6	(0.7)	5.3	(1.3)
Know of program but do not participate	45.4	(3.1)	49.1	(2.8)	59.2	(3.4)
Do not know of program, but might participate if did	31.7	(2.9)	31.1	(2.8)	22.2	(3.5)
Do not know of program, and not interested in participating	19.4	(2.3)	17.2	(2.2)	13.3	(2.0)
Total	100.0		100.0		100.0	

iv. For operations that were very familiar, somewhat familiar, or had heard of scrapie, **and** had acquired either ewes or rams, percentage of operations by frequency newly acquired breeding sheep (rams and/or ewes) were obtained during 2000 from a flock participating in the National Scrapie Flock Certification Program:

Frequency	Ewes		Rams	
	Percent Operations	Std. Error	Percent Operations	Std. Error
All ewes and rams	5.9	(2.8)	6.7	(1.8)
Some ewes and/or rams	3.7	(1.4)	4.3	(1.3)
Either no ewes or no rams	38.9	(4.3)	25.9	(2.8)
Did not know	51.5	(4.3)	63.1	(3.1)
Total	100.0		100.0	

For operations that had, at the very least, heard of scrapie, 10.8 percent used genetic selection to control or prevent the disease. Of these operations, 76.8 percent were using replacement rams genetically less susceptible to scrapie.

v. For operations that were very familiar, somewhat familiar, or had heard of scrapie, percentage of operations that did any genetic selection for scrapie control, by region:

Percent Operations									
Region									
Pacific		West Central		Central		Eastern		All Operations	
Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
15.6	(4.4)	12.5	(3.6)	8.9	(1.9)	9.4	(2.7)	10.8	(1.5)



vi. For operations that did any genetic selection for scrapie control, percentage of operations that carried out the following practices:

Practice	Percent Operations	Standard Error
Used genetically less-susceptible replacement rams (e.g., RR alleles)	76.8	(6.0)
Selected genetically less-susceptible ewes (e.g., QR or RR alleles)	27.0	(5.2)
Culled genetically more-susceptible ewes (e.g., QQ alleles)	17.2	(4.2)
Selected less-susceptible breeds of rams or ewes	22.6	(5.3)
Other	8.5	(4.4)

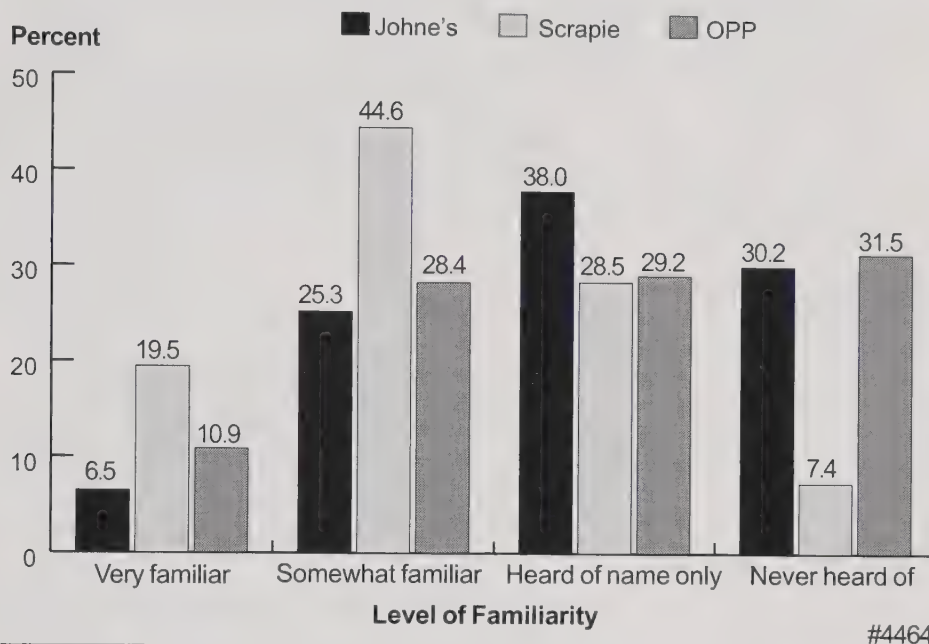
#### 4. Ovine Progressive Pneumonia (OPP)

The majority (68.5 percent) of producers had, at the very least, heard of OPP, although only 10.9 percent were very familiar with the disease.

a. Percentage of operations by familiarity with OPP before this study, and by region:

Percent Operations						
Familiarity	Region					
	Pacific		West Central		Central Eastern	
	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
Very familiar	12.1	(3.7)	6.1	(2.0)	13.0	(2.5)
Somewhat familiar	21.6	(4.0)	25.6	(3.2)	29.7	(3.6)
Heard of name only	33.3	(5.9)	29.7	(3.8)	28.0	(3.7)
Never heard of	33.0	(5.8)	38.6	(4.0)	29.3	(3.6)
Total	100.0		100.0		100.0	

### Percent of Operations by Level of Familiarity with Johne's, Scrapie, and OPP



For producers that had, at the very least, heard of OPP, 63.3 percent were either moderately or highly concerned about the disease.

i. For operations that were very familiar, somewhat familiar, or had heard of OPP, percentage of operations by level of concern<sup>1</sup> about OPP:

Level of Concern	Percent Operations	Standard Error
Not concerned	10.6	(1.6)
Little concerned	26.1	(2.5)
Moderately concerned	42.4	(2.8)
Highly concerned	20.9	(2.4)
Total	100.0	

<sup>1</sup> The specific question included "Answer this from the standpoint of overall potential effects on your flock and customers, regardless of whether this disease exists in your flock."

For producers that had, at the very least, heard of OPP, 10.6 percent had a flock health management program to control or prevent the disease at the time of the study.

ii. For operations that were very familiar, somewhat familiar, or had heard of OPP, percentage of operations that had a flock health management program to control or prevent OPP at the time of the study, by region:

Percent Operations									
Region									
Pacific		West Central		Central		Eastern		All Operations	
Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
12.8	(3.4)	10.1	(2.3)	10.7	(2.3)	9.1	(2.7)	10.6	(1.4)

iii. For operations that were very familiar, somewhat familiar, or had heard of OPP, **and** had acquired either ewes or rams, percentage of operations by frequency newly acquired breeding sheep (rams and/or ewes) were obtained during 2000 from a flock known to have tested negative for OPP:

Frequency	Ewes		Rams	
	Percent Operations	Std. Error	Percent Operations	Std. Error
All ewes and rams	5.4	(2.9)	10.0	(2.5)
Some ewes and/or rams	3.7	(2.1)	1.8	(0.7)
Either no ewes or no rams	22.7	(4.2)	17.8	(2.8)
Did not know	68.2	(4.8)	70.4	(3.4)
Total	100.0		100.0	

For producers that had, at the very least, heard of OPP, 6.6 percent tested and then removed from their flock all seropositive sheep and lambs. These seropositive animals may have been sold or just isolated in separate facilities. The majority of producers in the "other" category culled animals with clinical signs indicative of OPP infection.

iv: For operations that were very familiar, somewhat familiar, or had heard of OPP, percentage of operations by method used to control or prevent OPP:

Method	Percent Operations	Standard Error
Removed all seropositive sheep and lambs (sold and/or isolated in separate facilities)	6.6	(1.1)
Kept flock isolated from infected sheep and/or goats	18.4	(2.1)
Added only seronegative sheep (if sheep added) to flock	7.2	(1.6)
Tested goats (if present) for OPP	1.3	(0.5)
Other methods used to control or prevent OPP	8.5	(1.3)



For producers that had, at the very least, heard of OPP, 92.4 percent never tested for OPP.

v. For operations that were very familiar, somewhat familiar, or had heard of OPP, percentage of operations by option that best describes the operation's testing practice for OPP:

Testing Practice	Percent Operations	Standard Error
Never test	92.4	(1.3)
Test selected sheep only	4.3	(1.0)
Test majority of sheep two or more times a year	0.1	(0.1)
Test majority of sheep once a year	1.5	(0.7)
Test majority of sheep less frequently than once a year	1.7	(0.5)
Total	100.0	

For producers that had, at the very least, heard of OPP, the majority (86.3 percent) did not know their flock's current OPP status.

vi. For operations that were very familiar, somewhat familiar, or had heard of OPP, percentage of operations by current OPP status of their flock, and by region:

Flock Status	Percent Operations									
	Pacific		West Central		Central		Eastern		All Operations	
	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
Currently infected with OPP	0.4	(0.2)	2.1	(0.6)	1.2	(0.6)	0.1	(0.1)	1.2	(0.3)
Previously infected with OPP, but negative at time of study	3.0	(2.3)	0.7	(0.3)	2.0	(0.9)	0.8	(0.4)	1.6	(0.6)
Never infected with OPP	7.8	(2.3)	14.5	(2.6)	11.4	(3.4)	6.5	(2.4)	10.9	(1.8)
Did not know current OPP status	88.8	(3.3)	82.7	(2.8)	85.4	(3.5)	92.6	(2.4)	86.3	(1.9)
Total	100.0		100.0		100.0		100.0		100.0	

### 5. Toxoplasmosis

Nearly half (42.3 percent) of all operations had never heard of toxoplasmosis.

a. Percentage of operations by familiarity with toxoplasmosis:

Familiarity	Percent Operations	Standard Error
Very familiar	9.7	(1.4)
Somewhat familiar	25.4	(2.2)
Heard of name only	22.6	(2.1)
Never heard of	42.3	(2.3)
Total	100.0	

### 6. Q fever

Over three-quarters (76.4 percent) of all operations had never heard of Q fever.

a. Percentage of operations by familiarity with Q fever:

Familiarity	Percent Operations	Standard Error
Very familiar	2.6	(0.7)
Somewhat familiar	6.0	(1.2)
Heard of name only	15.0	(1.7)
Never heard of	76.4	(2.1)
Total	100.0	

### 7. Diseases present in the last 3 years

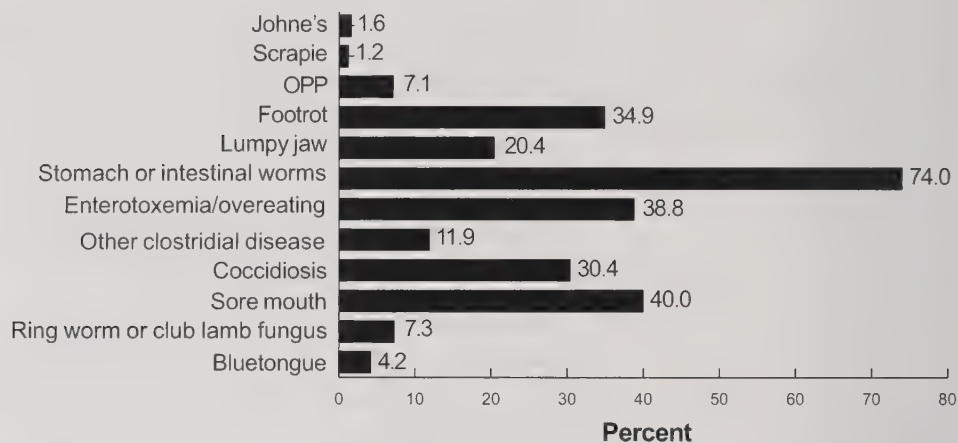
The three most common diseases present (suspected or confirmed) in flocks within the previous 3 years were: stomach or intestinal worms (74.0 percent of operations); sore mouth (40.0 percent of operations); and enterotoxemia/overeating disease (38.8 percent of operations). Only 1.2 percent of operations had scrapie (suspected or confirmed) during the last 3 years. This is consistent with findings of the 1996 NAHMS sheep study where 1.2 percent of operations had scrapie (suspected or confirmed) in the previous 5 years.

a. Percentage of operations where the following diseases were present (suspected or confirmed) in the last 3 years:

Disease	Percent Operations	Standard Error
Johne's disease (paratuberculosis)	1.6	(0.5)
Scrapie	1.2	(0.4)
Ovine progressive pneumonia (OPP)	7.1	(1.2)
Footrot	34.9	(2.2)
Caseous lymphadenitis (lumpy jaw)	20.4	(1.9)
Stomach or intestinal worms	74.0	(2.2)
Enterotoxemia/overeating disease (clostridium C&D)	38.8	(2.3)
Other clostridial disease (blackleg, malignant edema, braxy, tetanus, botulism, big head)	11.9	(1.4)
Coccidiosis	30.4	(2.3)
Sore mouth (contagious ecthyma)	40.0	(2.3)
Ring worm or club lamb fungus	7.3	(1.2)
Bluetongue	4.2	(1.0)

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**Percent of Operations Where the Following Diseases were Present  
(Suspected or Confirmed) During the Last 3 Years**



#4465



Most operations, when suspecting a disease in their flock, did not have the disease diagnosed by either a veterinarian or laboratory. Coccidiosis was the disease diagnosed most often (50.0 percent of operations) by either a veterinarian or laboratory.

b. For operations that reported the presence of the following diseases, percentage of operations where the disease was diagnosed by either a veterinarian or lab:

Disease	Percent Operations	Standard Error
Johne's disease (paratuberculosis)	33.3	(14.9)
Scrapie	26.7	(12.0)
Ovine progressive pneumonia (OPP)	21.7	(7.9)
Footrot	15.2	(2.8)
Caseous lymphadenitis (lumpy jaw)	24.9	(5.2)
Stomach or intestinal worms	24.8	(2.3)
Enterotoxemia/overeating disease (clostridium C&D)	30.9	(3.4)
Other clostridial disease (blackleg, malignant edema, braxy, tetanus, botulism, big head)	17.3	(3.5)
Coccidiosis	50.0	(4.7)
Sore mouth (contagious ecthyma)	17.9	(2.8)
Ringworm or club lamb fungus	22.5	(6.0)
Bluetongue	37.2	(12.3)

## 8. Injections

Overall, 81.7 percent of operations used the same needle on more than one animal when giving injections or vaccinations during 2000. As expected, the percentage of operations that routinely used the same needle on more than one animal increased as operation size increased.

a. Percentage of operations that routinely used the same needle on more than one animal when giving injections or vaccinations during 2000, by flock size:

Percent Operations							
Flock Size (Number of Ewes 1 Year or Older)							
Small (Less than 100)		Medium (100-499)		Large (500 or More)		All Operations	
Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
78.9	(2.5)	90.9	(1.5)	95.9	(1.2)	81.7	(2.0)

The majority (61.7 percent) of operations that used the same needle on more than 1 animal changed the needle after using it on 20 or fewer animals.

i. For operations that used the same needle on more than one animal, percentage of operations by average number of animals injected or vaccinated with the same needle:

Average Number Animals	Percent Operations	Standard Error
2 to 10	40.3	(2.7)
11 to 20	21.4	(2.1)
21 to 40	17.8	(2.1)
41 or more	20.5	(1.5)
Total	100.0	

The three vaccines given by the largest percentage of producers to either replacement or breeding ewes, nursing lambs, and breeding rams in 2000 were: Clostridia C and D; Tetanus toxoid; and Clostridia 7- or 8-way vaccines. It is possible that tetanus toxoid vaccination was under reported because it is often given in the same preparation as the C&D.

b. Percentage of operations that vaccinated replacement or breeding ewes, nursing lambs, and breeding rams against the following diseases during 2000:

Vaccine Type	Percent Operations					
	Replacement or Breeding Ewes		Type of Animal			
			Nursing Lambs		Breeding Rams*	
	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
Clostridia C&D (overeating)	48.4	(2.4)	66.9	(2.3)	36.0	(2.4)
Clostridia 7- or 8-way	20.9	(1.8)	15.3	(1.5)	16.8	(1.8)
Tetanus toxoid	37.5	(2.4)	55.1	(2.4)	30.7	(2.4)
Sore mouth (contagious ecthyma) (ORF)	5.1	(0.8)	14.0	(1.4)	4.2	(0.9)
<i>E. Coli</i> (scours)	2.1	(0.6)	2.9	(0.9)	1.4	(0.7)
Vibrio (campylobacter)	15.5	(1.7)	1.7	(0.6)	NA	(NA)
Enzootic abortion (EAE) (chlamydia)	7.6	(1.4)	1.1	(0.6)	NA	(NA)
Leptospirosis bacterin	7.7	(1.4)	1.2	(0.6)	2.8	(0.6)
Footrot (fusobacterium)	7.1	(1.2)	2.3	(0.7)	5.7	(1.0)
Pasteurella	1.7	(0.6)	1.8	(0.6)	1.4	(0.6)
Rabies	0.1	(0.1)	0.1	(0.1)	0.1	(0.1)
Bluetongue	0.6	(0.2)	0.2	(0.1)	0.5	(0.2)
Caseous lymphadenitis (corynebacterium pseudotuberculosis)	3.1	(0.9)	1.2	(0.5)	2.4	(0.7)
Ram epididymitis bacterin (brucella)	NA	(NA)	NA	(NA)	1.0	(0.5)

\*For operations that had breeding rams in 2000.

c. Percentage of operations that had weaned lambs (feeder lambs) intended for market during 2000:

Percent Operations	Standard Error
85.7	(1.6)

The most common vaccine given by the largest percentage of producers to feeder lambs intended for market during 2000 was Clostridia C and D (44.8 percent of operations). For operations that gave this vaccine, 11.7 percent gave it intramuscularly. The majority of operations in the "other" category gave pasteurella or caseous lymphadenitis vaccines to feeder lambs. Most of these vaccines were given subcutaneously. However, 34.2 percent of these operations gave vaccines by the intranasal route. These vaccinations were for parainfluenza Type 3 (PI3).

i. For operations that had weaned lambs (feeder lambs) intended for market during 2000, percentage of operations that gave these lambs the following vaccines **after** they were weaned, and usual route of administration:

			Percent Operations						
			Route				Other Route		
Given			Subcutaneous		Intramuscular				
Vaccine Type	Std. Pct. Error		Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Total
Clostridia C&D (overeating)	44.8 (2.6)		88.3	(2.6)	11.7	(2.6)	NA	(NA)	100.0
Clostridia (7- or 8-way)	9.6 (1.3)		86.0	(6.7)	14.0	(6.7)	NA	(NA)	100.0
Tetanus toxoid	28.9 (2.5)		84.1	(3.9)	15.9	(3.9)	NA	(NA)	100.0
E. Coli (scours)	1.1 (0.4)		96.9	(2.7)	3.1	(2.7)	NA	(NA)	100.0
Footrot (fusobacterium)	0.8 (0.3)		61.9	(20.8)	38.1	(20.8)	NA	(NA)	100.0
Bluetongue	0.1 (0.1)		78.5	(15.0)	21.5	(15.0)	NA	(NA)	100.0
Sore mouth (contagious ecthyma) (ORF)	4.9 (1.0)		NA	(NA)	NA	(NA)	NA*	(NA)	100.0
Other vaccines	1.2 (0.3)		48.6	(13.0)	17.2	(13.0)	34.2	(12.7)	100.0
Any vaccines	50.5 (2.6)		87.6	(2.5)	15.3	(2.8)	NA	(NA)	

\*Since all soremouth vaccinations are given percutaneously, respondents were not asked the route used for this vaccine.



ii. For operations that had weaned lambs (feeder lambs) intended for market during 2000 and vaccinated these lambs, percentage of operations that used the intramuscular route for injecting vaccinations, by region:

Percent Operations									
Region									
Pacific		West Central		Central		Eastern		All Operations	
Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
3.9	(1.6)	16.2	(6.3)	16.2	(3.9)	20.1	(7.1)	15.3	(2.8)

iii. For operations that had weaned lambs (feeder lambs) intended for market during 2000 and vaccinated these lambs, percentage of operations that used the intramuscular route for injecting vaccinations, by flock size:

Percent Operations					
Flock Size (Number Ewes 1 Year or Older)					
Small (Less than 100)		Medium (100-499)		Large (500 or more)	
Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
16.8	(3.6)	9.9	(1.9)	12.6	(3.1)

iv. For operations that had weaned lambs (feeder lambs) intended for market during 2000 and vaccinated these lambs, percentage of operations that used the intramuscular route for injecting vaccinations, by primary flock type:

Percent Operations					
Primary Flock Type					
Herded/Open Range		Fenced Range		Farm Flock	
Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
9.8	(5.5)	19.9	(8.3)	14.2	(2.9)

For operations that gave any vaccines to lambs intramuscularly (IM), 44.8 percent gave the vaccines primarily in the leg. The majority of operations that gave IM vaccinations in a location other than the neck, loin, or leg gave the vaccinations in the axillary region. Vaccination-caused abscesses and scar tissue in expensive cuts of meat can be avoided by using the subcutaneous route for injections or by giving IM injections in the neck.

d. For operations that gave any vaccines to weaned lambs via the intramuscular route, percentage of operations by primary location vaccine given and by flock size:

Percent Operations								
Flock Size (Number of Ewes 1 Year or Older)								
Location	Small (Less than 100)		Medium (100-499)		Large (500 or More)		All Operations	
	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
Neck	31.1	(9.8)	41.8	(9.5)	86.6	(7.2)	34.4	(8.5)
Loin	3.3	(2.9)	0.0	(--)	0.0	(--)	2.9	(2.5)
Leg	45.7	(10.2)	50.5	(9.5)	13.4	(7.2)	44.8	(8.9)
Other	19.9	(9.7)	7.7	(4.3)	0.0	(--)	17.9	(8.5)
Total	100.0		100.0		100.0		100.0	

i. For operations that gave any vaccines to weaned lambs via the intramuscular route, percentage of operations by primary location vaccine given and by primary flock type:

Percent Operations						
Primary Flock Type						
Herded/Open Range			Fenced Range		Farm Flock	
Location	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
Neck	72.8	(18.3)	83.4	(8.9)	24.5	(8.2)
Loin	0.0	(—)	0.0	(—)	3.5	(3.0)
Leg	27.2	(18.3)	11.8	(6.8)	51.2	(10.1)
Other	0.0	(—)	4.8	(3.5)	20.8	(9.9)
Total	100.0		100.0		100.0	

## E. Parasites and Deworming

### 1. Fecal testing

Overall, only 16.1 percent of operations conducted any fecal testing for parasites during 2000.

a. Percentage of operations where fecal testing for sheep parasites was done during 2000, by region:

Percent Operations									
Region									
Pacific		West Central		Central		Eastern		All Operations	
Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
12.1	(2.8)	16.3	(2.8)	15.3	(2.9)	22.6	(5.2)	16.1	(1.8)

## 2. Dewormer in feed

The majority (88.2 percent) of operations never used a dewormer in sheep feed for stomach or intestinal worms (excluding coccidia).

a. Percentage of operations by frequency of using a dewormer in sheep feed for stomach or intestinal worms (excluding coccidia):

Frequency	Percent Operations	Standard Error
Always	3.9	(1.0)
Sometimes	7.9	(1.5)
Never	88.2	(1.7)
Total	100.0	

## 3. Dewormer not in feed

Fewer operations in the West Central region (84.1 percent) used a dewormer that was **not** in feed during 2000 than in any other region. Overall, 91.5 percent of operations used a dewormer not given in sheep feed.

a. Percentage of operations that used a dewormer that was **not** in feed during 2000, by region:

Percent Operations									
Region									
Pacific		West Central		Central		Eastern		All Operations	
Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
94.1	(3.2)	84.1	(2.6)	94.1	(2.2)	94.7	(2.6)	91.5	(1.4)

Most operations dewormed the majority of their lambs during April through June. There was less seasonal variation in the deworming of ewes.

i. For operations that used a dewormer that was **not** in feed, percentage of operations that dewormed the majority of ewes and/or lambs, by quarter:

Quarter	Ewes <sup>1</sup>		Lambs <sup>2</sup>	
	Percent Operations	Std. Error	Percent Operations	Std. Error
January through March 2000	51.7	(2.5)	26.5	(2.5)
April through June 2000	68.2	(2.3)	75.5	(2.3)
July through September 2000	62.7	(2.4)	55.1	(2.8)
October through December 2000	50.6	(2.5)	34.8	(2.7)

<sup>1</sup>For operations that had ewes during the quarter.

<sup>2</sup>For operations that had lambs during the quarter.



"General prevention measure" was the most common reason for using a dewormer that was not in the feed for both ewes (96.8 percent of operations) and lambs (84.6 percent of operations), followed by "sheep or lambs were doing poorly" (31.8 percent of operations for ewes and 27.8 percent of operations for lambs). The majority of operations in the "other" category used a dewormer for ewes and lambs because of clinical signs observed in the flock.

ii. For operations that used a dewormer **not** in feed, percentage of operations by reasons for deworming ewes and lambs during 2000:

Reason	Ewes		Lambs	
	Percent Operations	Std. Error	Percent Operations	Std. Error
General prevention measure	96.8	(0.5)	84.6	(1.7)
Worms were seen	16.9	(1.7)	19.3	(2.0)
Fecal test results indicated a need	10.3	(1.5)	10.5	(1.6)
Sheep or lambs were thin or doing poorly	31.8	(2.3)	27.8	(2.1)
Other	3.4	(0.8)	3.4	(0.8)

For operations that used either an oral dewormer or an injectable dewormer, the most common dewormer used was Ivermectin. More operations used oral dewormers than either injectable or pour-on dewormers. Overall, the four dewormers used most commonly were: oral Ivermectin (45.7 percent of operations); Albendazole (41.3 percent of operations); Fenbendazole (31.4 percent of operations); and injectable Ivermectin (31.4 percent of operations).

iii. For operations that used a dewormer **not** in feed, percentage of operations that used the following dewormers during 2000:

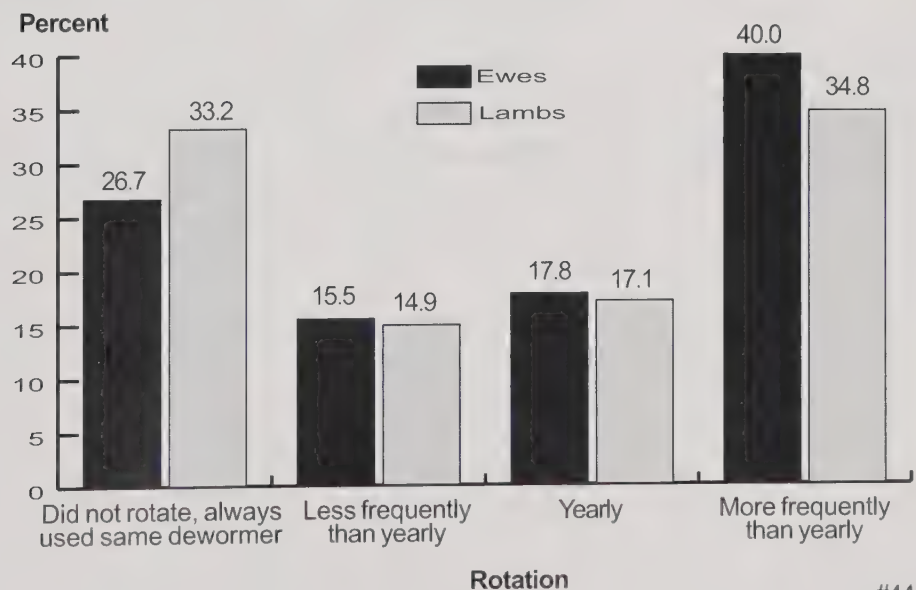
Dewormer Oral (Drench or Bolus)	Percent Operations	Standard Error
Albendazole (i.e., Valbazen®)	41.3	(2.4)
Fenbendazole (i.e., Panacur®, Safe-Guard)	31.4	(2.3)
Ivermectin (i.e., Ivomec® Sheep Drench)	45.7	(2.5)
Levamisole (i.e., Levasole, Tramisole, Ripericol)	23.5	(2.1)
Oxfendazole (i.e., Synanthic)	4.0	(0.8)
Pyrantel Pamoate (i.e., Strongid®-T)	0.5	(0.4)
Thiabendazole (i.e., Omnizole, TBZ-Thibenzole)	2.4	(0.6)
Other drench or bolus dewormers	2.3	(0.8)
<b>Dewormer Injectable</b>		
Doramectin (i.e., Dectomax® Injectable)	5.2	(1.1)
Ivermectin (i.e., Ivomec® Injectable)	31.4	(2.3)
Levamisole (i.e., Levasole, Tramisole, Ripericol)	9.3	(1.3)
Other injectable dewormers	0.9	(0.4)
<b>Dewormer Pour-On</b>		
Doramectin (i.e., Dectomax® Pour-on)	1.8	(0.5)
Levamisole (i.e., Levasole, Tramisole, Ripericol)	0.6	(0.4)
Moxidectin (i.e., Cydectin)	2.5	(0.9)
Other pour-on dewormers	2.2	(0.8)

The prevalence of anthelmintic resistance in the United States varies from flock to flock and by geographic region. Appropriate use of dewormers can reduce the risk of developing resistance. Rotating anthelmintics annually is one way producers can slow the appearance of resistance in the flock. Rotating more frequently may not be as beneficial. Over one-fourth of operations did not rotate dewormers (not in feed) for ewes (26.7 percent of operations) or lambs (33.2 percent of operations).

iv. For operations that used a dewormer **not** in feed, percentage of operations by frequency dewormers were rotated for ewes and lambs:

Rotation	Ewes		Lambs	
	Percent Operations	Std. Error	Percent Operations	Std. Error
Did not rotate, always used same dewormer	26.7	(2.2)	33.2	(2.4)
Less frequently than yearly	15.5	(1.8)	14.9	(2.0)
Yearly	17.8	(1.9)	17.1	(2.1)
More frequently than yearly	40.0	(2.4)	34.8	(2.6)
Total	100.0		100.0	

**Percent of Operations by Frequency Dewormers were Rotated for Ewes and Lambs**



#4466

The majority (68.7 percent) of operations that administered a dewormer not in feed dewormed ewes on pasture. For these operations, 75.1 percent did not exclude ewes from pasture after deworming (table 3.vii.). The second most common time for deworming ewes was within 1 month before going to pasture or rotating to a new pasture. For these operations, 42.2 percent did not exclude ewes from the pasture after deworming (table 3.vi.). Not all deworming medications kill parasite eggs. If an animal is dewormed and returned immediately to pasture it can contaminate the pasture by excreting viable parasite eggs.

v. For operations that used a dewormer **not** in feed, percentage of operations that dewormed ewes during the following time periods:

Time Period	Percent Operations	Std. Error
Within 1 month before lambing	37.7	(2.5)
Within 1 month after lambing	39.6	(2.5)
Within 1 month before going to pasture or rotating to new pasture	57.7	(2.5)
While on pasture	68.7	(2.3)
Other time periods	15.1	(1.7)

vi. For operations that dewormed within 1 month before going to pasture, percentage of operations by number of days after deworming ewes were kept from pasture:

Number of Days	Percent Operations	Standard Error
0	42.2	(3.2)
1 to 3	23.3	(2.8)
4 to 7	12.9	(2.3)
8 or more	21.6	(2.7)
Total	100.0	

vii. For operations that dewormed on pasture, percentage of operations by number of days after deworming that ewes were kept from pasture:

Number of Days	Percent Operations	Standard Error
0	75.1	(2.7)
1 to 3	14.1	(2.3)
4 to 7	3.2	(0.9)
8 to 30	5.4	(1.2)
31 or more	2.2	(0.8)
Total	100.0	

## F. Pasture Management

### 1. Grazing area

Almost all (98.1 percent) operations grazed sheep on pasture in 2000, and three-quarters (76.1 percent) of these operations also subdivided the pasture.

a. Percentage of operations that grazed sheep on pasture during 2000, by region:

Percent Operations									
Region									
Pacific		West Central		Central		Eastern		All Operations	
Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
100.0	(0.0)	99.1	(0.4)	97.2	(1.4)	97.6	(1.8)	98.1	(0.7)



b. For operations that grazed sheep on pasture during 2000, percentage of operations that subdivided pasture used for grazing sheep, by region:

Percent Operations									
Region									
Pacific		West Central		Central		Eastern		All Operations	
Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
83.5	(4.7)	78.7	(3.5)	71.8	(3.8)	78.3	(4.6)	76.1	(2.2)

In general, over half (57.0 percent) of operations grazed five or more sheep per acre. However, fewer operations (36.2 percent) in the West Central region grazed this many sheep per acre. Nearly half of the operations in the West Central region grazed less than two animals per acre.

c. For operations that grazed sheep on pasture during 2000, percentage of operations by maximum number of sheep per acre that grazed at one time during 2000, and by region:

Percent Operations									
Region									
Maximum Sheep per Acre	Pacific		West Central		Central		Eastern		All Operations
	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct. Std. Error
Less than 2	15.4	(3.7)	46.5	(4.1)	11.9	(2.1)	15.8	(3.6)	22.2 (1.8)
2 - 4.9	23.0	(5.3)	17.3	(3.6)	24.1	(3.6)	14.2	(3.7)	20.8 (2.1)
5 or more	61.6	(5.8)	36.2	(3.9)	64.0	(3.9)	70.0	(4.8)	57.0 (2.4)
Total	100.0		100.0		100.0		100.0		100.0

Overall, only 18.7 percent of operations irrigated any sheep grazing areas during 2000.

d. For operations that grazed sheep on pasture during 2000, percentage of operations that irrigated any sheep grazing areas at any time during 2000, by region:

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Percent Operations									
Region									
Pacific		West Central		Central		Eastern		All Operations	
Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
45.1	(6.0)	44.5	(3.9)	0.7	(0.4)	2.5	(1.6)	18.7	(1.6)

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## 2. Methods

Commingling sheep with cattle, alternating sheep grazing with either another domestic species or crop or hay production can reduce parasite loads on pastures. Less than one-third of operations alternated pasture with other domestic animals, commingled cattle with ewe/lamb pairs while on pasture, or alternated sheep pasture with crop or hay production. More operations in the Pacific region (32.6 percent) and the West Central region (39.1 percent) alternately used pasture for sheep and other domestic species than did operations in the Central region (23.8 percent) or the Eastern region (15.6 percent). More operations in the West Central region (44.6 percent) commingled cattle with ewe/lamb pairs than did any other region.

a. For operations that grazed sheep on pasture during 2000, percentage of operations by pasturing methods used during 2000, and by region:

Percent Operations										
Pasturing Method	Region									
	Pacific		West Central		Central		Eastern		All Operations	
	Std. Pct.	Error	Std. Pct.	Error	Std. Pct.	Error	Std. Pct.	Error	Std. Pct.	Error
Pasture alternately used for grazing sheep and other domestic species, e.g., cattle or horses	32.6	(5.5)	39.1	(3.7)	23.8	(3.5)	15.6	(3.7)	28.0	(2.1)
Commingled cattle with ewe/lamb pairs while on pasture	30.4	(5.3)	44.6	(4.0)	21.1	(3.5)	21.1	(4.1)	28.6	(2.1)
Pasture alternately used for grazing sheep, and for crop or hay production	34.2	(5.2)	43.5	(4.1)	22.4	(3.2)	37.5	(5.0)	31.7	(2.1)

### 3. Rotation

Only 67.8 percent of operations that grazed sheep on pasture in 2000 rotated pastures. For operations that did rotate pastures, over two-thirds kept their pasture free of sheep for an average of 22 days or more before using it again to graze sheep.

a. For operations that grazed sheep on pasture during 2000, percentage of operations that rotated pasture, by region:

Percent Operations									
Average Number of Days	Region								
	Pacific		West Central		Central		Eastern		All Operations
	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct. Std. Error
0 to 21	39.0	(6.9)	15.2	(2.9)	36.5	(4.9)	36.6	(6.5)	31.4 (2.7)
22 to 63	46.4	(7.1)	49.5	(4.5)	57.6	(5.0)	56.8	(6.7)	53.6 (2.9)
64 or more	14.6	(4.6)	35.3	(3.8)	5.9	(2.8)	6.6	(3.2)	15.0 (1.8)
Total	100.0		100.0		100.0		100.0		100.0

### 4. Crop residue

Nearly one out of three operations (29.0 percent) placed sheep on crop residue in 2000. For these operations, nearly half placed sheep on corn stalk residue. Many operations fed more than one kind of residue. The majority of operations placed sheep on another type of crop residue (see "other" category table i), usually alfalfa or hay residue.

a. For operations that grazed sheep on pasture during 2000, percentage of operations that ever placed sheep on crop residue during 2000:

Percent Operations	Standard Error
29.0	(2.1)

i. For operations that placed sheep on crop residue, percentage of operations by crop type:

Crop Type	Percent Operations	Standard Error
Corn stalks	48.7	(4.0)
Sugar beets	1.3	(0.3)
Other	73.8	(4.2)

## G. Feeding Practices

### 1. Ground feeding

a. Percentage of operations that ever placed harvested or commercial sheep feed directly on the ground:

Percent Operations	Standard Error
55.5	(2.4)

### 2. Grain

Overall, 93.7 percent of operations fed grain to their sheep during 2000. More operations in the Central region (100.0 percent) and Eastern region (97.5 percent) fed their sheep grain than did operations in the Pacific region (85.6 percent) or West Central region (84.7 percent).

a. Percentage of operations that fed grain to sheep during 2000, by region:

Percent Operations									
Region									
Pacific		West Central		Central		Eastern		All Operations	
Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
85.6	(3.5)	84.7	(2.6)	100.0	(0.0)	97.5	(1.6)	93.7	(0.9)



The majority (37.4 percent) of operations fed their lambs a custom blended mix which was neither a commercial bag or a balanced ration mix. The majority (38.1 percent) of operations fed their ewes a grain mix not listed ("other"), and most of these operations used a corn/grain mix. The grain type category "none" refers to operations that may have fed ewes but not lambs, or vice versa. For example, 10.2 percent of operations did not feed grain to their ewes but did feed some grain type to their lambs.

i. For operations that fed grain, percentage of operations by grain ration fed to the majority of ewes and lambs:

Grain Type	Ewes		Lambs	
	Percent Operations	Std. Error	Percent Operations	Std. Error
Commercial bag mix	12.0	(1.5)	24.0	(2.1)
Balanced ration based on forage analysis	3.9	(0.9)	3.4	(0.8)
Other custom blended mix	35.9	(2.4)	37.4	(2.4)
Other	38.1	(2.3)	23.4	(2.0)
None	10.2	(1.2)	11.7	(1.3)

Most operations (93.2 percent) that fed grain to their flock fed corn. Oats was the next most common grain fed (52.3 percent of operations).

ii. For operations that fed grain, percentage of operations that fed the following types of grain:

Grain Type	Percent Operations	Standard Error
Corn	93.2	(0.7)
Oats	52.3	(2.5)
Barley	23.9	(2.1)
Wheat	10.4	(1.3)
Other grain	24.5	(2.2)

For operations that fed grain to their flock, most operations (63.8 percent) fed no grain produced on the operation.

iii. For operations that fed grain, percentage of operations by the amount of operation-produced grain fed to sheep during 2000:

Amount of Grain Given Produced by Operations	Percent Operations	Standard Error
All	23.7	(2.1)
Some	12.5	(1.5)
None	63.8	(2.4)
Total	100.0	

### 3. Hay

a. Percentage of operations that fed hay to sheep during 2000, by region:

Percent Operations									
Region									
Pacific		West Central		Central		Eastern		All Operations	
Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
96.8	(1.3)	91.8	(1.3)	100.0	(0.0)	100.0	(0.0)	97.4	(0.4)

While most operations (97.4 percent) fed hay to their sheep during 2000, only 53.1 percent produced all of their own hay.

i. For operations that fed hay, percentage of operations by the amount of operation-produced hay fed to sheep during 2000:

<b>Amount of Hay Given Produced by Operations</b>	<b>Percent Operations</b>	<b>Standard Error</b>
All	53.1	(2.5)
Some	15.4	(1.7)
None	31.5	(2.3)
Total	100.0	

#### 4. Water sources

The most common water source that animals had access to in both winter (86.5 percent of operations) and summer (80.1 percent of operations) was "bucket/trough/waterer on ground or up to 2 feet off ground." The second most common source of water in both winter and summer was a stream (26.9 percent and 41.5 percent of operations, respectively). Over half of operations that listed "other" as a source of water reported that snow was the source. The most commonly reported "other" sources of water were snow in winter, and wells or springs in summer.

a. Percentage of operations where the flock typically had access to the following water sources during winter and summer:

	Percent Operations			
	Winter		Summer	
Typical Water Source	Percent	Standard Error	Percent	Standard Error
Pond/lake/reservoir	17.5	(1.5)	33.6	(2.2)
Stream	26.9	(2.0)	41.5	(2.3)
Bucket/trough/waterer on ground or up to 2 feet off ground	86.5	(1.4)	80.1	(1.7)
Bucket/trough/waterer 2 feet or more off ground	18.6	(1.8)	17.5	(1.8)
Other	6.2	(0.9)	5.1	(1.1)

The most common primary source of water in both winter (70.2 percent of operations) and summer (56.1 percent of operations) was "bucket/trough/waterer on ground or up to 2 feet off ground."

b. Percentage of operations by primary water sources during winter and summer:

Primary Water Source	Percent Operations			
	Winter		Summer	
	Percent	Standard Error	Percent	Standard Error
Pond/lake/reservoir	3.9	(0.8)	10.2	(1.2)
Stream	8.5	(1.1)	17.5	(1.7)
Bucket/trough/waterer on ground or up to 2 feet off ground	70.2	(2.0)	56.1	(2.3)
Bucket/trough/waterer 2 feet or more off ground	10.3	(1.3)	7.6	(1.2)
Other	3.5	(0.7)	1.4	(0.6)
Multiple sources used equally (can't pick a primary source)	3.6	(0.7)	7.2	(1.3)
Total	100.0		100.0	

For operations that had weaned lambs, most (61.5 percent) allowed them to share common feed or water sources with adult sheep.

c. For operations with weaned lambs, percentage of operations where weaned lambs shared common feed or water sources with adult sheep:

Shared Feed or Water	Percent Operations	Standard. Error
Yes	61.5	(2.4)
No	38.5	(2.4)
Total	100.0	

## 5. Flushing

Improving the nutritional status of a ewe just prior to breeding (flushing) can increase the ovulation rate of the ewe. Over half the operations flushed the majority of their ewes prior to breeding season during 2000. This was practiced more commonly in farm flocks (65.3 percent of operations) than in either herded/open range flocks (49.7 percent of operations) or fenced range flocks (50.0 percent of operations).

a. Percentage of operations where the majority of ewes were flushed prior to the breeding season during 2000, by primary flock type:

Percent Operations							
Primary Flock Type							
Herded/Open Range		Fenced Range		Farm Flock		All Operations*	
Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
49.7	(5.3)	50.0	(5.3)	65.3	(2.7)	62.1	(2.3)

\*Includes operations that were classified as primarily feedlots (see p.4, Primary Flock Type).

The average number of days that ewes were flushed prior to breeding season was 20.3 days.

i. For operations where the majority of ewes were flushed, average number of days flushed:

Average Number of Days	Standard Error
20.3	(0.7)



Grain was the most common supplemental feed given prior to breeding (81.5 percent of operations). Examples of "other" supplemental feed given included protein blocks and molasses.

ii. For operations where the majority of ewes were flushed, percentage of operations by types of supplemental feed given:

Supplemental Feed	Percent Operations	Standard Error
Richer pasture (extra energy)	33.4	(2.6)
Grain	81.5	(1.8)
Extra hay	25.6	(2.8)
Other	8.7	(1.3)

#### 6. Late gestation

Most operations increased the quality and/or quantity of either forage (58.4 percent of operations) or grain (65.2 percent of operations) for late gestation or lactating ewes.

a. Percentage of operations that used the following practices for late gestation or lactating ewes:

Practices	Percent Operations	Standard Error
Increase quality and/or quantity of forage	58.4	(2.4)
Increase quality and/or quantity of grain	65.2	(2.2)
Increase frequency of feeding	20.1	(1.9)
Add selenium	22.7	(1.9)
Add or increase mineral supplements	36.8	(2.3)
Other dietary changes	7.6	(1.4)

## 7. Lamb creep feed

Nearly three out of four operations (72.7 percent) provided nursing lambs creep feed during 2000.

a. Percentage of operations that provided nursing lambs creep feed during 2000, by primary flock type:

Percent Operations							
Primary Flock Type							
Herded/Open Range		Fenced Range		Farm Flock		All Operations*	
Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
20.1	(4.7)	52.3	(5.2)	79.8	(2.1)	72.7	(2.0)

\*Includes operations that were classified as primarily feedlots (see p.4, Primary Flock Type).

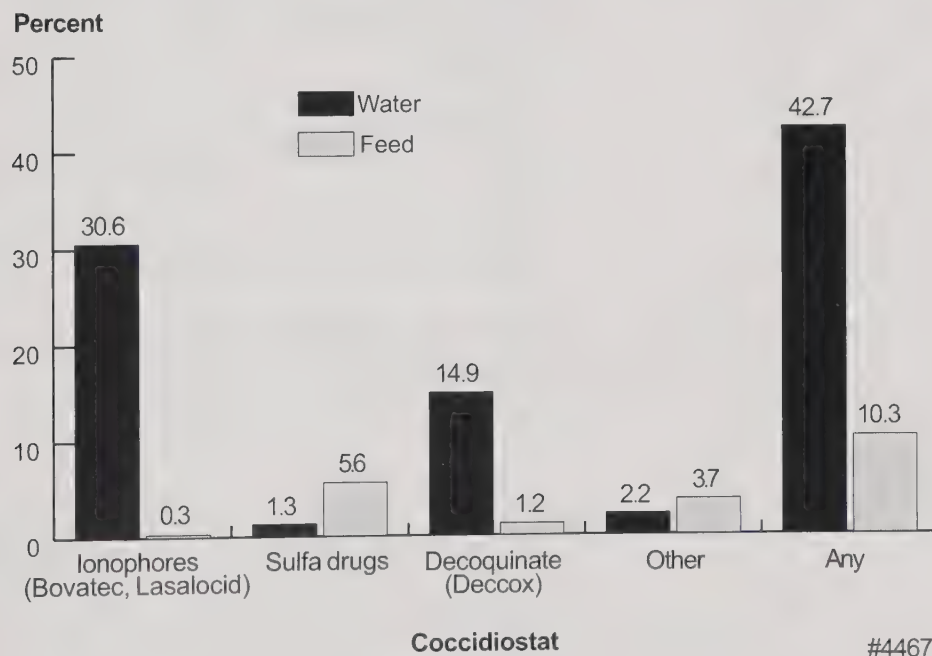
## 8. Treatments (coccidiostats, antibiotics, growth promotants, and hormone implants)

Subclinical coccidia in lambs is often responsible for significant reduction in weight gains. Therefore, coccidiostats are generally considered cost effective. When ionophores were given as coccidiostats they were given more commonly in feed (30.6 percent of operations) than in water (0.3 percent of operations). The most common coccidiostat given in water was sulfa drugs (5.6 percent of operations). Overall, 42.7 percent of operations gave "any" (some type) of coccidiostat in feed.

a. Percentage of operations that used the following coccidiostats in feed or water during 2000:

Coccidiostat	Feed		Water	
	Percent Operations	Std. Error	Percent Operations	Std. Error
Ionophores (Bovatec®, Lasalocid)	30.6	(2.2)	0.3	(0.2)
Sulfa drugs	1.3	(0.5)	5.6	(1.2)
Decoquinate (Deccox)	14.9	(2.0)	1.2	(0.3)
Other	2.2	(0.7)	3.7	(0.9)
Any	42.7	(2.4)	10.3	(1.5)

**Percent Operations that Used the Following Coccidiostats in Feed or Water During 2000**



Overall, very few operations gave antibiotics in either feed (19.6 percent) or water (4.0 percent) for disease treatment in 2000. The antibiotic used most commonly in feed was aureomycin premix (13.6 percent of operations). Tetracycline was the second antibiotic used most commonly in feed (7.6 percent of operations) and the antibiotic used most commonly in water (2.0 percent of operations). Since aureomycin (chlortetracycline) and tetracycline are in the same class of antibiotics, it is appropriate to point out that 21.2 percent of operations used a tetracycline formulation in feed, while only 3.4 percent used it in water.

b. Percentage of operations that used the following antibiotics for **disease treatment** in feed or water during 2000:

Antibiotic	Feed		Water	
	Percent Operations	Std. Error	Percent Operations	Std. Error
Aureomycin premix	13.6	(1.6)	1.4	(0.8)
Tetracycline (Chlormax, Terramycin)	7.6	(1.2)	2.0	(0.6)
Neomycin sulfate	0.1	(0.1)	0.3	(0.2)
Other	0.3	(0.1)	0.3	(0.2)
Any	19.6	(1.9)	4.0	(1.0)

c. Percentage of operations that used the following growth promotants in feed or water during 2000:

Growth Promotant	Feed		Water	
	Percent Operations	Std. Error	Percent Operations	Std. Error
Ionophores	9.6	(1.2)	0.1	(0.0)
Antibiotics	6.0	(1.1)	0.3	(0.2)
Either	14.1	(1.5)	0.4	(0.2)

Ralgro was the only hormone implant used in lambs for growth promotion during 2000, and only 1.1 percent of operations used it.

d. Percentage of operations that used the following hormone implants in lambs for growth promotion during 2000:

Hormone Implant	Percent Operations	Standard Error
Ralgro	1.1	(0.4)
Other	0.0	(0.0)
Any	1.1	(0.4)

e. Percentage of operations that used any coccidiostat, antibiotic, or growth promotant during 2000, by route:

Route	Percent Operations	Standard Error
Feed	52.2	(2.4)
Water	13.3	(1.6)
Hormone implant	1.1	(0.4)
Any	56.2	(2.3)

Only 28.0 percent of operations placed thin ewes with younger sheep to increase the ewes' feed intake. Generally, placing thin ewes with younger sheep is not recommended because younger sheep may be exposed to chronic diseases such as Johne's.

f. Percentage of operations that ever placed thin ewes with younger sheep to increase the ewes' feed intake:

Percent Operations	Standard Error
28.0	(2.2)

### 9. Nutritional disorders during the last 3 years

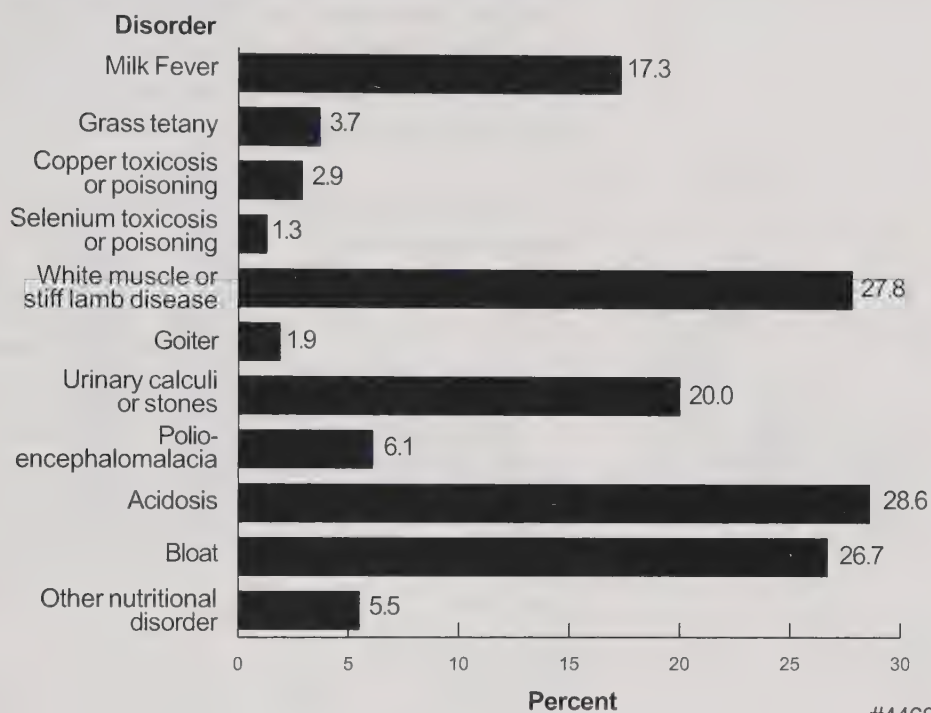
The 3 most common nutritional disorders seen in the 3 years previous to the study were: acidosis (28.6 percent of operations); white muscle or stiff lamb disease (27.8 percent of operations); and bloat (26.7 percent of operations).

a. Percentage of operations where any sheep experienced the following disorders within the last 3 years:

Disorder	Percent Operations	Standard Error
Milk fever (hypocalcemia)	17.3	(1.8)
Grass tetany (magnesium deficiency)	3.7	(0.6)
Copper toxicosis or poisoning	2.9	(0.6)
Selenium toxicosis or poisoning	1.3	(0.4)
White muscle or stiff lamb disease (vitamin E/selenium deficiency)	27.8	(2.1)
Goiter (iodine deficiency or toxicity)	1.9	(0.7)
Urinary calculi or stones	20.0	(1.9)
Polioencephalomalacia (thiamine deficiency)	6.1	(0.9)
Acidosis ("grain overload")	28.6	(2.1)
Bloat	26.7	(2.0)
Other nutritional disorder	5.5	(1.1)



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**Percent of Operations Where Any Sheep Experienced the Following Disorders Within the Last 3 Years**

**10. Source of nutritional information**

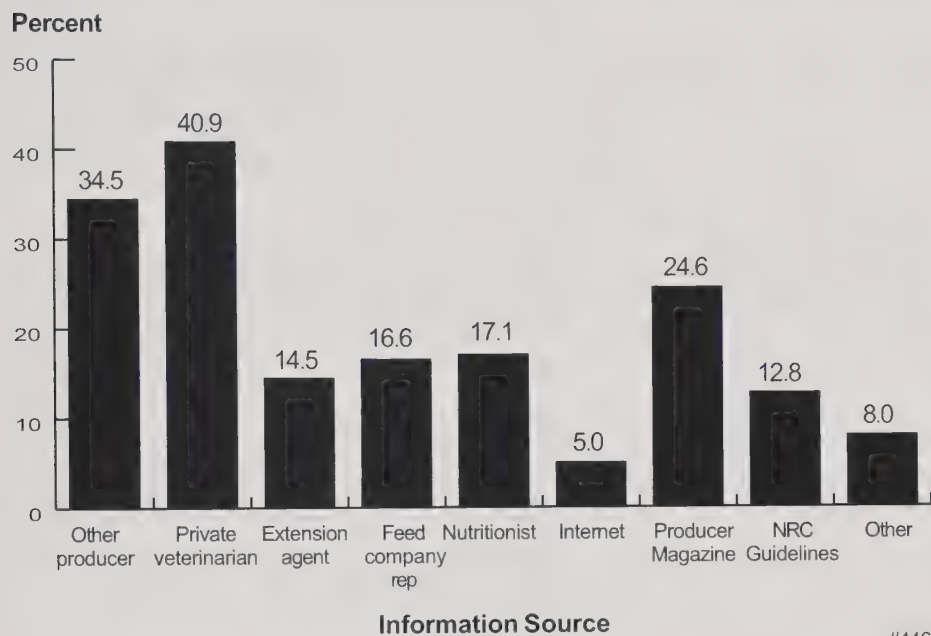
The top three sources of nutritional information reported to be very important by producers were: private veterinarians (40.9 percent of operations); other sheep producers (34.5 percent of operations); and producer magazines (24.6 percent of operations). A majority (62.8 percent) of operations indicated that nutritionists were not important as a source of information about sheep nutrition.

a. Percentage of operations by importance of the following information sources about sheep nutrition:

Percent Operations Level of Importance							
	Very Important		Somewhat Important		Not Important		Total
Information Source	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error	Percent
Other sheep producers	34.5	(2.3)	42.8	(2.4)	22.7	(2.0)	100.0
Private veterinarian	40.9	(2.4)	35.2	(2.2)	23.9	(2.0)	100.0
Extension agent	14.5	(1.6)	38.9	(2.4)	46.6	(2.4)	100.0
Feed company representative	16.6	(1.8)	36.8	(2.3)	46.6	(2.4)	100.0
Nutritionist	17.1	(1.9)	20.1	(1.9)	62.8	(2.3)	100.0
Internet	5.0	(1.1)	20.3	(2.1)	74.7	(2.3)	100.0
Producer magazines	24.6	(2.1)	46.7	(2.4)	28.7	(2.2)	100.0
National Research Council guidelines (NRC)	12.8	(1.7)	25.5	(2.1)	61.7	(2.3)	100.0
Other	8.0	(1.2)	3.7	(1.0)	88.3	(1.5)	100.0

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**Percent of Operations that Rated the Following as Very Important  
Sources of Information About Sheep Nutrition**



#4469

### 11. Supplementation for ewes

Overall, 98.8 percent of operations supplemented ewes with “any salt” in 2000, and 96.5 percent supplemented lambs with salt in some form in 2000. Trace mineral salt was provided most commonly, with 69.3 percent of operations giving it to ewes and 67.0 percent giving it to lambs. Few operations gave vitamin injections to their flock in 2000. Less than one-third (30.3 percent) of operations gave a vitamin injection to lambs and only 16.5 percent gave a vitamin injection to ewes.

a. Percentage of operations that supplemented the majority of ewes and lambs with the following nutrients during 2000:

Nutrient	Ewes		Lambs	
	Percent Operations	Std. Error	Percent Operations	Std. Error
Plain salt	40.2	(2.4)	39.4	(2.4)
Iodized salt	23.0	(1.9)	22.0	(1.8)
Selenium salt	22.2	(1.8)	21.1	(1.8)
Trace mineral salt	69.3	(2.3)	67.0	(2.3)
Other salt	5.7	(0.9)	6.3	(1.0)
Any salt	98.8	(0.4)	96.5	(0.7)
Vitamin E/selenium injection	13.5	(1.7)	28.5	(2.2)
Other vitamin or mineral injection	7.1	(1.2)	6.4	(1.0)
Any vitamin injection	16.5	(1.8)	30.3	(2.2)
Tub molasses	31.6	(2.2)	25.8	(2.1)
Other molasses	19.1	(2.1)	20.7	(2.1)
Any molasses	47.7	(2.4)	44.2	(2.4)

i. Percentage of operations that supplemented the majority of **ewes** with selenium via a selenium salt, vitamin E/selenium injection, or either during 2000, by region:

Percent Operations								
Region								
Pacific		West Central		Central		Eastern		
Nutrient	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
Selenium salt	58.8	(5.9)	20.8	(3.0)	10.6	(2.2)	28.2	(5.0)
Vitamin E/selenium injection	20.0	(4.7)	11.2	(2.9)	12.7	(2.7)	13.8	(3.4)
Either	69.8	(5.4)	27.8	(3.5)	22.2	(3.3)	38.3	(5.3)

ii. Percentage of operations that supplemented the majority of **lambs** with selenium via a selenium salt, vitamin E/selenium injection, or either, during 2000, by region:

Percent Operations								
Region								
Pacific		West Central		Central		Eastern		
Nutrient	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
Selenium salt	58.5	(5.9)	19.4	(2.9)	9.4	(2.2)	27.6	(5.0)
Vitamin E/selenium injection	37.5	(5.8)	16.7	(3.0)	30.3	(3.7)	36.1	(5.1)
Either	70.5	(5.7)	30.7	(3.5)	36.3	(3.8)	52.7	(5.5)

**12. Nutritional analysis in last 3 years**

Overall, very few operations submitted either grain, pasture, or dried forage to a laboratory for analysis. Dried forage was submitted most commonly (13.2 percent of operations), while only 4.8 percent of operations submitted grain and 1.6 percent submitted pasture samples. Some dried forage and custom blended hay may have been analyzed before being purchased. The producer would not necessarily know whether or not the analysis had been done, which may have contributed to under reporting

a. Percentage of operations that submitted grain, pasture, or dried forage from the sheep operation to a laboratory for nutritional analysis during the last 3 years:

<b>Percent Operations</b>						
<b>Submitted to Lab</b>						
<b>Analysis</b>	<b>Grain</b>		<b>Pasture</b>		<b>Dried Pasture</b>	
	<b>Percent</b>	<b>Standard Error</b>	<b>Percent</b>	<b>Standard Error</b>	<b>Percent</b>	<b>Standard Error</b>
Yes	4.8	(1.0)	1.6	(0.4)	13.2	(1.5)
No	92.9	(1.1)	97.1	(0.8)	83.3	(1.6)
None used last 3 years	2.3	(0.6)	1.3	(0.7)	3.5	(0.8)
Total	100.0		100.0		100.0	



For operations that submitted pasture or forage samples for analysis in the last 3 years, the majority (83.1 percent) had protein, energy, and fiber analyzed.

b. Percentage of operations that had the following analysis conducted on sheep pasture or forage during the last 3 years, by flock size:

<b>Percent Operations</b>								
<b>Flock Size (Number of Ewes 1 Year or Older)</b>								
<b>Analysis</b>	<b>Small (Less than 100)</b>		<b>Medium (100-499)</b>		<b>Large (500 or More)</b>		<b>All Operations</b>	
	<b>Pct.</b>	<b>Std. Error</b>	<b>Pct.</b>	<b>Std. Error</b>	<b>Pct.</b>	<b>Std. Error</b>	<b>Pct.</b>	<b>Std. Error</b>
Protein, energy, fiber (proximate)	78.6	(7.1)	91.9	(2.4)	85.7	(3.5)	83.1	(4.4)
Calcium and phosphorus	53.4	(8.8)	61.1	(5.4)	69.2	(5.1)	57.3	(5.6)
Trace minerals	37.9	(8.9)	35.0	(5.4)	40.7	(5.9)	37.5	(5.7)
Other	4.7	(2.3)	10.5	(3.8)	8.4	(2.6)	6.7	(1.8)

**13. Water tested in last 3 years**

Only 13.1 percent of operations had sheep's drinking water tested during the previous 3 years. This was consistent among all three flock sizes.

a. Percentage of operations that had sheep's drinking water tested for the following during the last 3 years, by flock size:

Percent Operations								
Flock Size (Number of Ewes 1 Year or Older)								
Analysis	Small (Less than 100)		Medium (100-499)		Large (500 or More)		All Operations	
	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
Minerals	6.3	(1.4)	6.1	(1.3)	8.2	(1.5)	6.4	(1.1)
Bacteria	9.6	(1.6)	8.7	(1.6)	8.7	(1.6)	9.4	(1.3)
Contaminants	8.3	(1.7)	6.9	(1.4)	8.9	(1.6)	8.1	(1.4)
Other	3.2	(0.8)	2.6	(1.0)	1.7	(0.8)	3.1	(0.6)
Any	13.1	(2.0)	12.7	(1.8)	14.1	(2.0)	13.1	(1.6)

**14. Age of facilities**

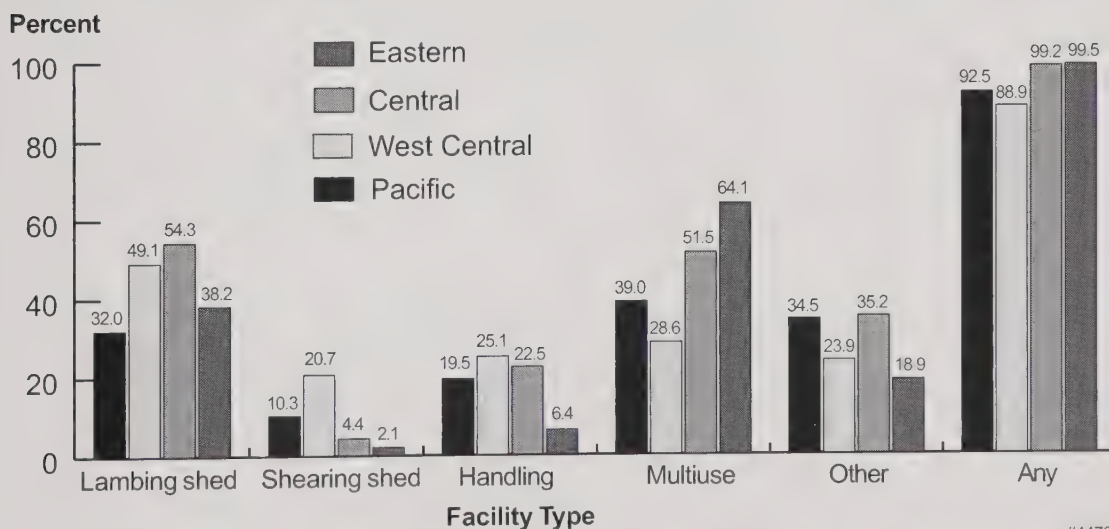
Nearly all operations (95.6 percent) had some kind of facility for sheep. Lambing sheds were the most common facilities (47.8 percent of operations), followed by multiuse facilities (45.4 percent of operations). Multiuse facilities were seen more often in the Central region (51.5 percent of operations) and the Eastern region (64.1 percent of operations) than in the Pacific region (39.0 percent of operations) or the West Central region (28.6 percent of operations). Shearing sheds were the least common facilities (9.2 percent of operations), and were seen more often in the West Central region (20.7 percent of operations) than in any other region.

a. Percentage of operations with the following facilities, by region:

Percent Operations									
Facility	Region								All Operations
	Pacific		West Central		Central		Eastern		
	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	
Lambing shed	32.0	(5.5)	49.1	(4.0)	54.3	(4.0)	38.2	(5.4)	47.8 (2.4)
Shearing shed	10.3	(2.2)	20.7	(2.9)	4.4	(1.0)	2.1	(1.0)	9.2 (1.0)
Handling facility	19.5	(4.5)	25.1	(3.3)	22.5	(2.9)	6.4	(2.0)	20.6 (1.8)
Multiuse	39.0	(5.5)	28.6	(3.9)	51.5	(3.9)	64.1	(5.3)	45.4 (2.4)
Other*	34.5	(5.8)	23.9	(3.3)	35.2	(3.7)	18.9	(4.4)	30.0 (2.2)
Any	92.5	(3.3)	88.9	(2.9)	99.2	(0.7)	99.5	(0.5)	95.6 (1.0)

\*Most often a facility described as nonspecific shelter or lambing shed.

Percent of Operations With the Following Facilities, by Region



#4470

i. Percentage of operations with the following facilities, by flock size:

Percent Operations						
Flock Size (Number of Ewes 1 Year or Older)						
Facility	Small (Less than 100)		Medium (100-499)		Large (500 or More)	
	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
Lambing shed	48.1	(3.0)	46.7	(2.7)	47.0	(3.2)
Shearing shed	6.5	(1.1)	14.9	(1.8)	33.4	(2.9)
Handling facility	18.2	(2.1)	27.7	(2.5)	35.4	(2.9)
Multiuse	48.7	(3.0)	37.0	(2.6)	20.5	(2.5)
Other*	30.4	(2.7)	30.1	(2.5)	21.5	(3.2)
Any	96.9	(1.2)	92.2	(1.8)	85.3	(2.0)

\*Most often a facility described as nonspecific shelter or loafing shed.

Surprisingly, a few sheep facilities were built in the 1800s. More lambing sheds in the Eastern region (12.1 percent) were built in the 1800s than in any other region. Overall, 29.4 percent of "other facilities" were built in the 1990s, although the facility type was not specified.

b. For operations with the following sheep facilities, percentage of facilities by time period the facility was built and by region:

Period Built	Percent Facilities									
	Region									
	Pacific		West Central		Central		Eastern		All Operations	
Lambing Shed	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
1800s	2.0	(1.2)	0.1	(0.1)	3.7	(2.1)	12.1	(5.7)	3.5	(1.3)
1900-1940	43.4	(10.1)	16.7	(3.7)	32.2	(5.3)	37.4	(9.8)	29.6	(3.4)
1941-1970	11.1	(4.0)	26.6	(3.8)	27.3	(4.5)	5.9	(2.4)	23.6	(2.7)
1971-1990	25.9	(8.8)	31.3	(4.2)	27.1	(4.7)	21.8	(7.5)	27.5	(3.0)
1991-2000	17.6	(8.2)	25.3	(4.7)	9.7	(3.9)	22.8	(8.7)	15.8	(2.7)
Total	100.0		100.0		100.0		100.0		100.0	
<b>Shearing Shed</b>										
1800s	0.0	(0.0)	1.2	(0.8)	1.6	(1.4)	0.0	(0.0)	1.1	(0.6)
1900-1940	41.6	(10.7)	24.4	(5.5)	26.9	(11.1)	49.7	(23.7)	28.1	(4.5)
1941-1970	16.0	(5.5)	28.2	(5.7)	25.8	(9.6)	0.0	(0.0)	25.1	(4.1)
1971-1990	38.9	(9.9)	15.3	(3.2)	44.0	(11.6)	42.2	(22.7)	24.9	(3.8)
1991-2000	3.5	(2.3)	30.9	(7.7)	1.7	(1.6)	8.1	(5.1)	20.8	(5.5)
Total	100.0		100.0		100.0		100.0		100.0	
<b>Handling Facility</b>										
1800s	0.0	(0.0)	0.5	(0.4)	0.3	(0.3)	0.0	(0.0)	0.3	(0.2)
1900-1940	33.2	(9.0)	10.8	(3.0)	25.7	(5.2)	23.4	(13.4)	21.9	(3.2)
1941-1970	10.9	(5.1)	24.7	(4.6)	28.4	(6.5)	30.8	(15.6)	25.0	(3.9)
1971-1990	39.2	(9.7)	32.8	(5.3)	31.9	(6.3)	14.7	(9.0)	32.6	(4.0)
1991-2000	16.7	(7.1)	31.2	(7.8)	13.7	(4.5)	31.1	(15.3)	20.2	(3.8)
Total	100.0		100.0		100.0		100.0		100.0	

Percent Facilities										
Period Built	Region									
	Pacific		West Central		Central		Eastern		All Operations	
Multiseuse	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
1800s	1.3	(0.9)	0.6	(0.4)	3.5	(1.7)	18.4	(5.1)	5.7	(1.4)
1900-1940	32.0	(7.2)	14.8	(4.1)	25.5	(4.8)	26.9	(7.1)	24.8	(3.1)
1941-1970	28.7	(5.5)	31.0	(6.8)	21.4	(4.8)	8.5	(2.7)	21.3	(2.9)
1971-1990	19.9	(5.1)	32.3	(7.4)	35.2	(6.8)	23.4	(15.3)	30.6	(4.0)
1991-2000	18.1	(6.6)	21.3	(8.0)	14.4	(3.2)	22.8	(6.2)	17.6	(2.6)
Total	100.0		100.0		100.0		100.0		100.0	
Other*										
1800s	0.3	(0.3)	0.0	(0.0)	0.8	(0.5)	2.3	(1.3)	0.6	(0.3)
1900-1940	6.4	(2.5)	4.7	(1.9)	16.9	(3.2)	31.3	(7.9)	12.7	(2.0)
1941-1970	11.7	(5.8)	17.4	(4.8)	33.3	(5.0)	9.2	(4.9)	23.4	(3.2)
1971-1990	27.9	(8.9)	34.3	(5.8)	35.4	(4.7)	38.2	(12.6)	33.9	(3.4)
1991-2000	53.7	(12.2)	43.6	(6.2)	13.6	(3.5)	19.0	(8.4)	29.4	(4.5)
Total	100.0		100.0		100.0		100.0		100.0	

\*Most often a facility described as nonspecific shelter or loafing shed



## Section II: Methodology

### A. Needs Assessment

NAHMS develops study objectives by exploring existing literature and contacting industry members about their informational needs and priorities during a needs assessment phase. The needs assessment for the NAHMS Sheep 2001 study afforded producers and others affiliated with the sheep industry the opportunity to prioritize sheep health and productivity issues so that the study could focus on the areas of greatest importance. The objective of the needs assessment was to collect information from U.S. sheep producers and other commodity specialists about what they perceived to be the most important sheep health and productivity issues. A driving force of the needs assessment was the desire of NAHMS researchers to receive as much input as possible from a variety of sheep producers, as well as from industry experts and representatives, veterinarians, sheep extension specialists, universities, and sheep organizations. The data collected from the needs assessment helped set the focus and objectives for the study by concentrating on areas most important to the industry.

The primary needs assessment data collection method used was a population survey (the "Sheep Health Study Survey") to collect qualitative data. The survey was accessible in one of two ways: by linking to the USDA:APHIS:VS Web site or by calling a 1-800 telephone number. The survey was made available beginning February 15, 2000, and it was initially scheduled to terminate March 31, 2000. However, in order to capture as many responses as possible, and because there was a fairly high response rate, the data collection period was extended to April 30, 2000. The Web/phone hits were automated and put into a database for statistical analysis at a later date. Surveys also were distributed to all State veterinarians, as well as to a number of sheep extension specialists, sheep organization leaders, and university agriculture researchers in every State. The survey also was advertised in American Sheep Industry Association (ASI) newsletters, in major sheep magazines such as *The Shepherd*, and in numerous other sheep association publications and bulletins. A total of 459 surveys were completed, either on the Internet, on the phone, or via mailed-in hard copy. Conference calls and five focus-group meetings (USAHA 1998, American Sheep

Industry 1999 and 2000, and the American Farm Bureau Federation in 1999 and 2000) with industry leaders also were simultaneously conducted to gain a balanced perspective of current sheep health concerns during discussion-based meetings.

**Specific objectives for the NAHMS Sheep 2001 study:**

1. Estimate the regional and national prevalence of specific diseases and conditions of sheep, such as Johne's, intestinal parasites, abortions, and ovine progressive pneumonia.
2. Conduct genomic testing for genetic factors that may be related to susceptibility to clinical signs of scrapie. Describe the prevalence of potential risk factors believed to be associated with scrapie.
3. Describe health management practices used by U.S. sheep producers affecting morbidity (e.g., footrot) and mortality. These practices include animal movement and identification, feeding practices, biosecurity procedures, use of veterinary services, source of health information, vaccination, and treatment practices.
4. Describe nutritional practices and micronutrient intake levels that may impact sheep health by region.

**B. Sampling and Estimation**

**1. State selection**

The preliminary selection of States to be included in the study was done in January 2000, using the National Agricultural Statistics Service (NASS), USDA January 29, 1999, Sheep and Goat Report. A goal for NAHMS national studies is to include States that account for at least 70 percent of the animal and producer populations in the United States. The initial review of States identified 16 major States with 82 percent of the inventory but only 62 percent of the operations. A review in January 2000 suggested an increase in the number of States in the Central and Eastern regions.

A workload memo identifying the 19 States in relation to all States in terms of size (inventory and operations) was provided to the USDA: APHIS: VS Regional Directors in February 2000. Each of the Regional Directors sought input from their respective States about being included or excluded from the study. The 19 States provided coverage of 86 percent of the sheep in the United States and 70 percent of the operations. The States were: CA, CO, IA, ID, IL, IN, KS, MN, MT, NM, OH, OR, PA, SD, TX, UT, VA, WI, and WY. By midyear, three additional States were included based on State interest : AR, NV and WA. As of January 1, 2001, these 22 States accounted for 87.4 percent (6,039,000 head) of the sheep and lambs in the United States and 72.3 percent (47,700) of the operations with sheep or lambs in the United States (See appendix II for respective data on individual States.)

## **2. Operation selection**

A review of the size of operations based on data from the 1997 Census of Agriculture showed a large proportion of small farms (54.1 percent of all the 65,790 farms with sheep or lambs had 1-24 head). For this reason the reference population was chosen to be those operations with one or more head.

The list sampling frame was provided by the NASS. Within each State a stratified random sample was selected. The size indicator was total sheep and lamb inventory for each operation. As shown in Appendix II, the number of sheep producers has been declining at a steep pace. This suggested that the results from the list frame sample might produce an expected high level of sampling units that were no longer in the sheep business, deceased, etc. To minimize this drop in sampling efficiency a screening sample concept was applied. NASS selects a sample of sheep producers in each State for making the NASS January 1 sheep estimates. The list sample from the January 2000 survey was used as the screening sample (n=12,258). Those producers reporting one or more sheep or lambs on January 1, 2000, were included in the sample for contact in January 2001. Due to the large predicted workload the sample was reduced in some States by excluding a replicate(s), as necessary, for a final screening sample of 9,964 operations. For the VS phase, operations with 20 or more ewes that participated in the NASS phase were invited to continue in the study.

### **3. Population inferences**

Inferences from Phase I data collection cover the population of sheep producers with at least 1 sheep in the 22 States. These States accounted for 72.3 percent of the operations with sheep or lambs in the United States and 87.4 percent of the sheep and lamb inventory as of January 1, 2001. All respondent data were statistically weighted to reflect the population from which they were selected. The inverse of the probability of selection for each operation was the initial selection weight. This selection weight was adjusted for nonresponse within each State and size group to allow for inferences back to the original population from which the sample was selected. For those operations eligible for Phase II data collection (those with 20 or more ewes), weights were adjusted for those operations not wanting to continue to the study's second phase. This weight was adjusted again for nonresponse to Phase II data collection. The 22-State target population of operations with 20 or more ewes was estimated to represent 42.1 percent of all sheep operations and 92.6 percent of ewes in the 22 States on January 1, 2001 (see Appendix II).

### **C. Data Collection**

1. Phase I: General Sheep Management Report, December 29, 2000-January 26, 2001. NASS enumerators administered the General Sheep Management Report. The interview took slightly over 1 hour.
2. Phase II: Reference of Sheep Health in the United States, 2001. Data were collected from producers by Federal or State veterinary medical officers (VMOs) or animal health technicians (AHTs) from February 5, 2001, to April 27, 2001. The interview took approximately 1.5 hours.

### **D. Data Analysis**

#### **1. Validation and estimation**

- a. Initial data entry and validation for the General Sheep Management Report were performed in individual NASS State offices. Data were entered into a SAS data set. NAHMS national staff performed additional data validation on the entire data set after data from all States were combined.



b. Completed VS Initial Visit Questionnaires were sent to State NAHMS Coordinators, where they were manually reviewed for accuracy and then sent to CEAH. Data entry and validation for the initial visit were completed at CEAH and entered into SAS.

## 2. Response rates

a. Phase I: Of the 9,964 operations in the screening sample, 4,884 operations had no sheep or lambs on January 1, 2000, and were therefore ineligible for the NAHMS Sheep 2001 study. This left a total of 5,080 operations to be contacted by NASS in January 2001 (see table below). Of these 5,080 sheep operations, 3,210 participated in this initial phase of the Sheep 2001 study. This phase occurred from December 29, 2000, to January 26, 2001, and included the administration of a questionnaire by NASS enumerators.

Response Category	Number Operations	Percent Operations
No sheep on January 1, 2001	468	9.2
Out of business <sup>1</sup>	159	3.1
Refusal	870	17.1
Survey complete and VMO consent	1,775	34.9
Survey complete, refused VMO consent	993	19.6
Survey complete, ineligible for VMO	442	8.7
Out of scope (prison, research farm, etc.)	51	1.0
Inaccessible	322	6.4
Total	5,080	100.0

<sup>1</sup>Operations that sold land and/or sheep and had no intention of returning to sheep business.

b. Phase II: VS initial visit response categories are shown below for all 1,775 producers turned over to VS with 20 or more ewes. Of these, 1,101 producers participated.

<b>Response Category</b>	<b>Number Operations</b>	<b>Percent Operations</b>
Survey completed	1,101	62.0
Producer not contacted	149	8.3
Poor time of year or no time	189	11.0
Did not want anyone on operation	6	0.3
Bad experience with government veterinarians	7	0.3
Did not want to do another survey or divulge information	131	7.4
Told NASS they did not want to be contacted	7	0.3
Ineligible (no sheep)	32	1.8
Other reason	40	2.2
Unable to contact	113	6.4
Total	1,775	100.0



## Appendix I: Sample Profile

### A. Responding Operations

#### 1. Responding Operations by Flock Size

Phase I: General Sheep Management Report		Phase II: VMO Initial Visit	
Flock Size (Number of Sheep)	Number of Responding Operations	Flock Size (Number of Ewes)	Number of Responding Operations
1-24	448	Less than 100	536
25-99	956	100-499	368
100-999	1,370	500 or more	197
1,000 or more	436	Total	1,101
Total	3,210		

#### 2. Responding Operations by Region

Phase I: General Management Report		Phase II: VMO Initial Visit
Region	Number of Responding Operations	Number of Responding Operations
Pacific	416	168
West Central	1,335	436
Central	1,048	340
Eastern	411	157
Total	3,210	1,101

**3. Responding Operations by Primary Flock Type**

	<b>Phase I: General Sheep Management Report</b>	<b>Phase II: VMO Initial Visit</b>
<b>Primary Flock Type</b>	<b>Number of Responding Operations</b>	<b>Number of Responding Operations</b>
Herded/Open Range	219	87
Fenced Range	938	293
Farm Flock	1,975	714
Feedlot	78	7
Total	3,210	1,101

## Appendix II: U.S. Sheep and Lamb Inventory and Operations

### A. Regional Summary

Nass <sup>1</sup>							
Region	State	Number (Thousand Head) January 1, 2001		Number of Operations with Sheep 2000	Percent		
		Ewes 1 Year or Older	All Sheep and Lambs		Ewes on Operations With 20 or More Ewes	Sheep on Operations With 20 or More Ewes	Operations with 20 or More Ewes
Pacific	California	320	840	3,000			
	Oregon	120	245	3,000			
	Washington	35	54	1,200			
	Total	475	1,139	7,200	90.6	86.3	31.9
West Central	Colorado	165	420	1,900			
	Idaho	195	275	1,000			
	Montana	265	360	2,000			
	Neveda	68	95	300			
	New Mexico	165	255	900			
	Texas	710	1,150	6,800			
	Utah	300	390	1,500			
	Wyoming	340	530	900			
	Total	2,208	3,475	15,300	96.9	81.5	46.9
Central	Arkansas	N/A	N/A	N/A			
	Illinois	48	75	2,400			
	Indiana	45	66	2,200			
	Iowa	144	270	4,700			
	Kansas	58	110	1,500			
	Minnesota	90	170	2,600			
	South Dakota	265	420	2,300			
	Wisconsin	53	80	2,200			
	Total	703	1,191	17,900	86.5	77.0	44.6
Eastern	Ohio	86	142	3,600			
	Pennsylvania	54	81	2,500			
	Virginia	37	61	1,300			
	Total	177	284	7,400	78.9	77.6	40.1
Total (22 States)		3,563 (87.1% of U.S.)	6,089 (87.4% of U.S.)	47,800 (72.3% of U.S.)	92.6	81.2	42.1
Total U.S. (50 States)		4,091	6,965	66,100			

N/A = not available

1 Source: National Agricultural Statistics Service (NASS), USDA; NASS Sheep and Goats, February 1, 2002

## B. Size Group Summary

### 1. Source: United States Census of Agriculture, U.S. Department of Commerce, 1997

Sheep and Lamb Size Groups	Sheep and Lamb Inventory Dec. 1, 1997 (Thousand Head)	Farms (Operations) With Sheep and Lambs 1997
1-24	349	35,584
25-99	959	20,461
100-299	963	6,010
300-999	1,237	2,429
1,000-2,499	1,255	820
2,500-4,999	1,000	297
5,000 or more	2,059	189
Total	7,822	65,790

### 2. Source: United States Department of Agriculture, NASS

Breeding Sheep	Percent	
	Inventory January 1, 2001	Operations
1-99	28.8	90.8
100-499	23.8	7.5
500-4,999	33.7	1.6
5,000 or more	13.7	0.1
Total	100.0	100.0

## Sheep 2001 Study: Completed and Expected Outputs and Related Study Objectives

1. Estimate the regional and national prevalence of specific diseases and conditions of sheep, such as Johne's, intestinal parasites, abortions, and ovine progressive pneumonia.
  - Johne's and the U.S. Sheep industry (info sheet)
  - Intestinal parasites in U.S. Sheep (info sheet)
  - Seroprevalence of Ovine Progressive Pneumonia in U.S. sheep (info sheet)
2. Conduct genomic testing for genetic factors that may be related to susceptibility to clinical signs of scrapie. Describe the prevalence of potential risk factors believed to be associated with scrapie.
  - PrP genotype distributions of U.S. sheep
  - Scrapie associated risk factors and related management practices in the United States.
3. Describe health management practices used by U.S. sheep producers affecting morbidity (e.g., footrot) and mortality. This would include animal movement and identification, feeding practices, biosecurity procedures, use of veterinary services, source of health information, vaccination, and treatment practices.
  - Part I: Reference of Sheep Management in the United States, 2001, July 2002
  - Highlights of NAHMS Sheep 2001: Part I
  - **Part II: Reference of Sheep Health in the United States, 2001, April 2003**
  - Highlights of NAHMS Sheep 2001: Part II and III, April 2003
  - Lamb Marketing Patterns in the United States, 2000 (info sheet) April 2003
  - Part III: Lambing Practices, Spring 2001, April 2003
  - Part IV: Sheep Feedlot Health and Management
  - Biosecurity Practices on U.S. Sheep Operations, April 2003
  - Quality Assurance, expected spring 2003
  - Vaccination and Treatment Practices on U.S. Sheep Operations, expected spring 2003
4. Describe nutritional practices and micronutrient intake levels that may impact sheep health, by region
  - Composition of Forage Analyzed as part of the Sheep 2001 Study, expected spring 2003
  - Nutritional Practices of U.S. Sheep Producers, expected spring 2003









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